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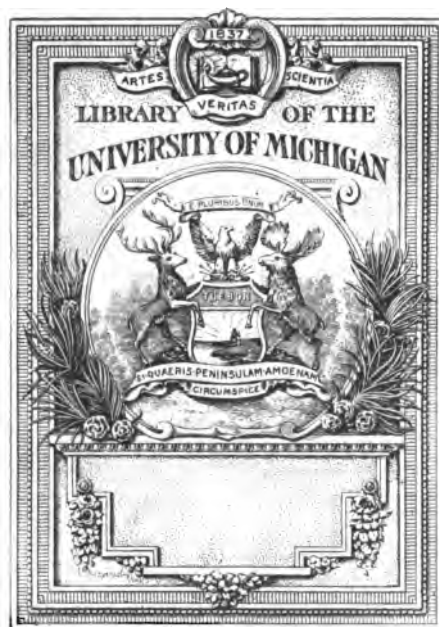
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LIST OF RECORDED EARTHQUAKES
IN
CALIFORNIA, LOWER CALIFORNIA, OREGON,
AND
WASHINGTON TERRITORY.

COMPILED FROM PUBLISHED WORKS AND FROM PRIVATE INFORMATION.

By

EDWARD S. HOLDEN, LL.D.,

PRESIDENT OF THE UNIVERSITY OF CALIFORNIA, AND DIRECTOR OF THE LICK OBSERVATORY.

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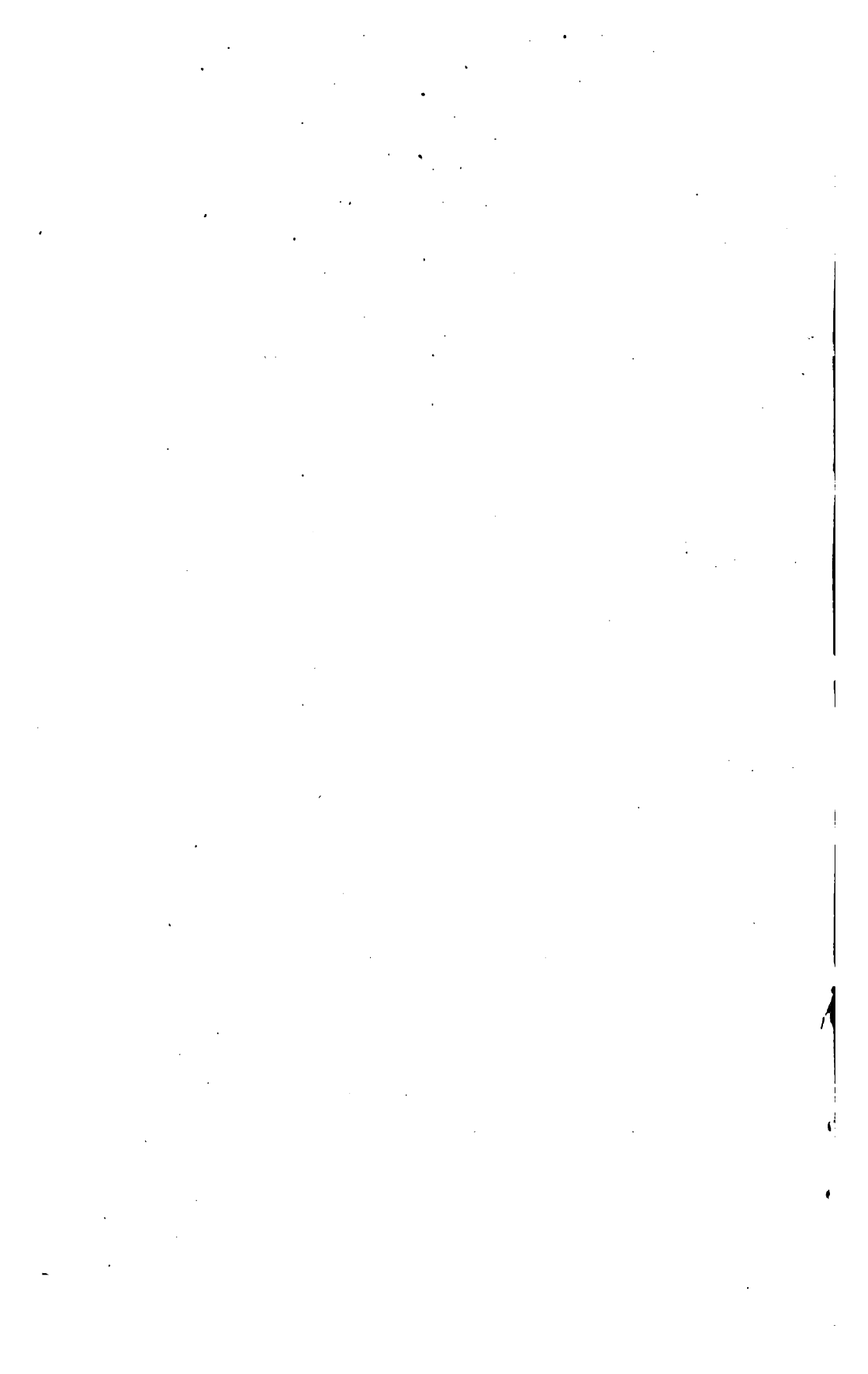
1887.

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INTRODUCTION.

As the Lick Observatory, at Mount Hamilton, and the University of California, at Berkeley, have already begun accurate registration of earthquake shocks and tremors by means of delicate seismometers, it has seemed to be important to gather in one list all the various records of past shocks in the region west of the Sierras. The sources of information have been:

First—Printed lists of earthquake shocks in the scientific journals, such as the lists of MALLET, PERREY, ROCKWOOD, FUCHS, TRASK and others.

Second—Accounts of earthquakes in printed books, magazines and newspapers.

Third—Lists of shocks put at my disposition by various gentlemen, specially a list by Mr. THOS. TENNENT, of San Francisco; a list by Prof. H. G. HANKS; and a very extensive collection kindly furnished by Mr. H. H. BANCROFT from his manuscript records.

Fourth—Verbal accounts from various gentlemen.

I have to thank Professor ROCKWOOD, of Princeton College, for putting me in the way of gaining much of this information. I have also to express my great obligations to the Board of Directors of the Mechanics' Institute Library, to the Council of the California Academy of Sciences, and to the Librarians of the Mechanics' Institute, Mercantile and Academy of Science libraries in San Francisco, the University of California Library at Berkeley, and of the State Library at Sacramento, for exceptional facilities afforded me in the consultation of books. Mr. W. C. WINLOCK, of the U. S. Naval Observatory, has kindly consulted, in the Library of Congress, books which were not available in California. The various sources of information have been thoroughly examined, and the necessary data for a brief reference list, or index, have been extracted and set in order in the catalogue which follows. I wish also to express my grateful thanks to those who have kindly aided in this latter part of the work. The list of books and periodicals consulted is given in the following

BIBLIOGRAPHY OF WORKS RELATING TO EARTHQUAKE PHENOMENA IN CALIFORNIA, OREGON AND WASHINGTON TERRITORY.

- Annual Statistician, San Francisco; 8vo. (A. S.)
- Annals of San Francisco, by F. SOULÉ, etc., New York; 8vo.
- BACHE (A. D.): Notice of Earthquake Waves, etc.; U. S. C. S. Report, 1855, p. 342, and 1862, p. 238.
- BANCROFT (H. H.): History of the Pacific States; 8vo. (H. H. B.)
- : Ms. notes kindly communicated. (B. Ms.)
- DETAILLE (C.): Statistique des tremblements de terre. *L'Astronomie*, 1884-1887.
- FUCHS (C. W. C.): Statistik der Erdbeben [1865-1885] Sitzungsber. d. Wiener Akad. 1885, Bd. 92, heft 3.
- HALLEY (WM.): Centennial Book of Alameda County, pp. 257-269. Oakland. 1876; 8vo. Detailed account of damage done by the shock of 1868, October 21, in Alameda County.
- HANKS (H. G.): Professor H. G. HANKS, late State Mineralogist, has been kind enough to put all his manuscripts and other material at my disposition. It is here referred to as H. Ms.
- HITTELL (T. H.): History of California. San Francisco; 8vo. (T. H. H.)
- HOLDEN (E. S.): Ms. notes by him, 1887. (E. S. H.)
- HOPKINS (R. C.): in Report of the Commissioner of the General Land Office for 1871, p. 213; [He has examined the Spanish Archives from 1767 forward; and is of the opinion that the shocks of 1809, 1812 and of October, 1868, were of about the same severity.]
- MALLET (R.): Catalogue of recorded Earthquakes from 1606 B. C. to A. D. 1850, by ROBERT MALLET, C.E., M.R.I.A., in the *Report of the British Association*, 1854. (R. M.)
- MILNE (J.): Earthquakes and other earth movements. New York, 1886; 8vo.
- MINING AND SCIENTIFIC PRESS: for the years 1864-1872. Weekly newspaper, San Francisco; 4to.
- NATURE: Vols. 1-34 (1869-1886). London; 8vo.
- PERREY (A.): Note sur les tremblements de terre ressentis en * * * * *Bull. de l'Acad. R. de Belgique*, 1845; tome 13, p. 234. 1849; tome 17, p. 216. 1850; tome 18, p. 291. 1851; tome 19, part 1, p. 353. 1852; tome 20, p. 39. 1853; tome 21, p. 457. 1854; tome 22, part 2, p. 526. 1855; tome 23, p. 23.
- PERREY (A.): Note sur les tremblements de terre ressentis en * * * * *Bruzelles, Mémoires Couronnées*, 1856; tome 8; (1859). 1857; tome 10; (1860). 1858; tome 12; (1861). 1859; tome 13; (1862). 1860; tome 14; (1862). 1861; tome 16; (1864). 1862; tome 16; (1864). 1863; tome 17; (1865). 1864; tome 18; (1866). 1865; tome 19; (1867). 1866-67; tome 21; (1870). 1868; tome 22; (1872). 1869; tome 22; (1872). Supplement; tome 23; (1873).

- PERREY (A.): Sur les tremblements de terre aux Etats-Unis et au Canada. *Ann. de la Soc. d' Emulation des Vosges*, tome 7, 2e cahier, 1850. [Not in any library in California and not in the Library of Congress.]
- PERREY (A.): Notes sur les tremblements de terre en * * * 1850; *Mém. de l'Acad. de Dijon*, Année 1851. 1851; *Ibid* 1852-53. 1853; *Ibid* 1854. Les tremblements de terre, etc., de la Côte N.O. d'Amérique. *Ibid* 1865. [NOTE: It is likely that many of the "eruptions" of Oregon and California mountains, which are noted by PERREY, were due to forest fires. E. S. H.]
- ROCKWOOD (C. G.): Notes on American Earthquakes, by Professor C. G. ROCKWOOD, Jr., Ph.D. Princeton, N. J. (C. G. R.) From the *American Journal of Science*. Third series. Vols. 1872-1887.
- ROWLANDSON (THOS.): A Treatise on Earthquake Dangers, Causes and Palliatives. (Referred to as ROWLANDSON.) San Francisco, 1868; 8vo.
- SAN FRANCISCO DIRECTORY: ("Chronological History" in each vol.), 1859-1887, 8vo.; referred to as S. F. D.
- SAN FRANCISCO (Chamber of Commerce): Report of Sub-Committee on Earthquake Topics, pp. 14-15 of Report of C. of C. for 1870. San Francisco, 1870; 8vo. [A manuscript report is there referred to, which is believed to be in the possession of Dr. BLAKE.]
- SHALER (N. S.): On California earthquakes (1850-1866) in the *Atlantic Monthly*, Vol. 25. Boston, 1870. [This paper contains no original data, but is compiled from the lists of Dr. TRASK.]
- SHALER (N. S.): The Stability of the Earth; *Scribners' Magazine*, vol. I, p. 276 (1887).
- SIMPSON (Sir GEORGE): Narrative of a journey round the world during 1841 and 1842. Two vols. London, 1847. (See vol. 1, p. 344.)
- STILLMAN (J. D. B.): Concerning the late Earthquake (1868). *Overland Monthly*, November, 1868.
- TENNENT (T.): List of earthquakes in San Francisco, 1851-1887, from a manuscript kindly furnished by Mr. TENNENT. Many of these are also printed in the *Annual Statistician*, q. v. (T. T.)
- TRASK (J. B.): A Register of Earthquakes in California from 1800 to 1863. [Reprinted from Proc. Cal. Acad. Sci., S. F.] San Francisco, 1864, 8vo.
- TRASK (J. B.): Earthquakes in California, from 1812 to 1855. [Proceedings of the California Academy of Natural Sciences], by Dr. JOHN B. TRASK. Vol. I (1854-57). Vol. III (1863-67). Vol. IV, part 1. (J. B. T.)
- TRASK (J. B.): Direction and velocity of the earthquake in California of the 8th and 9th January, 1857. *Amer. Jour. Sci.*, Jan., 1858, vol. 25, p. 146.
- VEATCH (J. A.): In *Mining and Scientific Press*, 1868, March 31, has an article on Earthquakes in San Francisco, and specially on their direction.
- WASHINGTON (United States Light House Board): *Annual Report* for fiscal year 1885-6, pp. 24, 25; 8vo. [Earthquakes will be regularly reported, in future, by lighthouse keepers. I owe to the courtesy of Commander EVANS, Naval Secretary, the notice of several other shocks which have been reported in manuscript and not printed, between 1887, June 24, and 1887, August 17. E. S. H.]

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WASHINGTON (United States Signal Service): Monthly Weather Review. (U.S. W. R.)

WHITNEY (J. D.): On the Earthquake of 1872, March 26. There is a résumé of Professor WHITNEY's article (*Overland Monthly*, vol. 9), by Professor ROCKWOOD, in *Amer. Jour. Sci.*, vol. VI, 1872.

From the above sources of information the following catalogue has been derived.

For each shock there is given, when possible, *first*, the year, month and day; *second*, the hour. The hour is here given exactly as it is found in the original. Usually it is expressed in local civil time. In Dr. TRASK's list it is intended to be astronomical time (0h. is noon, and 12h. midnight), though there are probably several errors in this datum. For the later lists it is usually Pacific standard time. In Mr. TENNENT's observations it is San Francisco local mean time to and including March 25, 1884, and after that date Pacific standard time. Professor ROCKWOOD's plan to avoid the danger of confounding A. M. and P. M. dates, is to adopt the system of numbering the hours in the civil day from 0 to 24 (0h. is midnight, 12h. is noon). I have not brought the hours to a single uniform standard, in order that I might avoid introducing mistakes in copying, and especially because very few of the times are really accurate. Mr. TENNENT's list is probably quite the best in this regard. Since January 1, 1887, all the stations of the Southern Pacific Railroad, and since August, 1887, those of the Atlantic and Pacific Railway, receive a noon signal (Pacific standard time) from the Lick Observatory, and since this date, therefore, there is more likelihood that the times in this catalogue are accurate. *Third*, the place or places where the shock has been felt. Here the abbreviation "S. F." stands for San Francisco. When necessary the name of the county is added for more precision. *Fourth*, the intensity of the shock, expressed either in common language or in terms of some arbitrary scale. Professor ROCKWOOD, in indicating the intensity, has used the adjectives: 1, very light; 2, light; 3, moderate; 4, strong; 5, severe; 6, destructive; but has added a Roman numeral to indicate the intensity, according to the ROSSI-FOREL scale, adopted by Swiss and Italian seismologists. In Professor ROCKWOOD's papers, very light is II or III; light, IV; moderate, V or VI; strong, VI or VII; severe, VIII; destructive, IX or X.

I strongly recommend the use of the ROSSI-FOREL scale, on account of the definiteness of the classification and because of

the regularity of the gradations. In order to make it better known in California, I reprint it here:

THE ROSSI-FOREL SCALE.

I.

Microseismic shock—recorded by a single seismograph, or by seismographs of the same model, but not putting seismographs of different patterns in motion; reported by experienced observers only.

II.

Shock recorded by several seismographs of different patterns; reported by a small number of persons who are at rest.

III.

Shock reported by a number of persons at rest; duration or direction noted.

IV.

Shock reported by persons in motion; shaking of movable objects, doors and windows, cracking of ceilings.

V.

Shock felt generally by every one; furniture shaken; some bells rung.

VI.

General awakening of sleepers; general ringing of bells; swinging of chandeliers; stopping of clocks; visible swaying of trees; some persons run out of buildings.

VII.

Overturning of loose objects; fall of plaster; striking of church bells; general fright, without damage to buildings.

VIII.

Fall of chimneys; cracks in the walls of buildings.

IX.

Partial or total destruction of some buildings.

X.

Great disasters; overturning of rocks; fissures in the surface of the earth; mountain slides.

Fifth—A brief reference to the source of information, so that in nearly all cases the original record can be consulted, if desired. Exceptionally heavy shocks, such as those of 1865, 1868 and 1872, are treated with more fullness than the lighter ones proportionately.

I shall be very grateful for additions and corrections to the list; and I beg that those into whose hands the present publication may come, will communicate to me the particulars of any earth-

quake shocks which may occur in future. I should be glad to have either newspaper extracts, or fuller written accounts.

The information asked for can be very conveniently given by answering the following questions, which are copied from circular No. 3 of the Division of Volcanic Geology of the United States Geological Survey, prepared by Captain C. E. DUTTON, U. S. A., in charge :

1. Post Office address; town, county, and State.
2. Place and date of observation.
3. Name and address of the observer, if other than the writer.
4. Position and occupation of observer at time of the shock, and character of the ground. State whether observer was in the house or out of doors; what kind of a house; up stairs or down; what doing at the time; whether the ground at surface was rock, clay, sand, or loam; about how far down to solid rock.

NOTE.—If the shock was not felt in your neighborhood, although noticed at places not very far distant, do not fail to answer these first four questions, as negative reports are of great interest in defining the limits of the disturbed area, etc. State also the nearest point to your station where the shock was felt.

5. State as exactly as possible the *time of commencement* and the *duration* of each shock.

The exact time of the beginning of a shock (to the nearest second), one of the most important of all observations, is difficult to get correctly, because of the great velocity with which the wave travels (about three miles a second), and because the watch or clock must be immediately compared with a clock known to be keeping standard time. If several hours have elapsed before the comparison is made, another comparison should be made an hour later, in order to find whether your time-piece is gaining or losing, and how much. Unless it is stated that this has been done, the observation cannot be regarded as a good one till confirmed by other reports. Telegraph operators, railroad officials, watchmakers, etc., have especially good opportunities for answering this question correctly, and their coöperation is most earnestly solicited.

6. Give any facts that you can as to sounds accompanying shocks and as to the direction in which the earthquake wave seemed to travel.

If any sound, other than the mere creaking of woodwork, etc., accompanied the shock, state as fully and accurately as possible whether it preceded, accompanied, or followed the shock, and what interval there was, if any; also what the sound was like. Describe the character of the shock, whether a tremor or an undulatory motion, etc., and whether you yourself or others had any clear impression as to the direction in which it was moving, the facts upon which this impression was based, and whether people agreed as to the direction.

7. Which number on the Rossi-Forel scale of earthquake intensity best expresses the intensity of the shock in your vicinity?

8. Give, also, any further particulars of interest, whether they are from observation or from hearsay.

If a chandelier was noticed to swing, describe it, and state the direction and amount of swing. If pictures swung, state direction of wall, and whether pictures on other walls at right angles to the first were also put in motion. If doors were closed or opened by the shock, state the direction of the wall in which they are set. If a clock was stopped, give the exact time it indicated (and anything known, as how fast or how slow it was), its position, the direction in which it was facing, and the length of the pendulum. If any changes occurred in the ground, such as depressions or elevations of the surface, fissures, emissions of sand or water, describe them fully. Mention any unusual condition of the atmosphere; any strange effects on animals (it is often said that they will feel the first tremors of a shock before people notice it at all); character of damage to buildings, general direction in which walls, chimneys, etc., were overthrown. Springs, wells, and rivers are often noticeably affected even by slight shocks, and any information in regard to such changes will be valuable.

9. Name of the writer.

NOTE.—In replying to these questions, they need not be repeated; but the answers should be *numbered* to correspond to the questions.

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LIST OF RECORDED EARTHQUAKES.

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TABLES OF THE NUMBER OF EARTHQUAKES WHICH ARE RECORDED IN EACH MONTH OF EACH OF THE YEARS, 1850-1887, IN CALIFORNIA, WASHINGTON AND OREGON.

In the three following tables I have counted the days in each month of each year on which shocks (supposed to be different) have occurred. For example, a shock felt at a given hour at San Francisco and at Oakland is counted as one ; but shocks at different places, as San Diego and San Francisco, on the same day, are counted separately when they are not known to be parts of the same phenomenon.

TABLE (A.) OF THE NUMBER OF EARTHQUAKES WHICH ARE RECORDED IN CALIFORNIA, OREGON, ETC., IN THE YEARS 1850-1887.

YEAR.	Total	January	February	March	April	May	June	July	August	September	October	November	December
1850	8	1	1	1		1	1		2	1			
1851	15			1	1	3	1					4	5
1852	6				1							3	2
1853	22	4	2	1	2		1	1		1	3	4	3
1854	22	2	1	2	3	4	1	2	1	1	3	1	1
1855	14	2	1		1		2	2		2	2		2
1856	25	5	1	3	1	3			2	5		1	2
1857	31	6	1	3	1	3	1	1	2	2	2	6	3
1858	10		2						2	5		1	
1859	19	1		1	1				5	4	1	2	4
1860	20	2	1	3	5	2	1			3		2	1
1861	11	2		2	2		1	2			1		1
1862	19	1		1		5	8	1		1	1		1
1863	17	4	2				2	4	1		1		3
1864	22		1	4		2	2	4	2	3	3		1
1865	42	3	2	6	4	1	1		2	3	16	2	2
1866	24	1	3	4		3	3	1	2	1		1	5
1867	6	1	1		1					1		1	1
1868	54			1		6	2	1	3		10	3	2
1869	31	4	2	1	2	2	4	2		4	5		5
1870	19	2	3	2	6	3			2	1			
1871	19		1	2	1	1	2	5	2	2	2		1
1872	41		3	7	15	2	1		1	2	5	2	3
1873	15		2	1	3	1	1	1	1		2	2	1
1874	10	2		2		1	1		2				2
1875	17	1	1				3		1		1	5	5
1876	7	1		1		1			1		2		1
1877	16	2	1			2	1	2	3	3	1	1	
1878	17		1	2	1	2	1	2		3	2	1	2
1879	8		2			2			2		1		1
1880	26	1		2	3	1	1		2	1		5	10
1881	23	7	3	1	2		1	2	1	1	2	3	
1882	26	1	1	5	2	1	1	3	4	1	5	1	1
1883	28	2	1	3	1			2	2	4	7	1	5
1884	27	4		2	5		3	1	3	3	3	3	
1885	39	5	5	2	7	1	3	4		2	3	1	6
1886	12	1				3	1	2		1	2	1	1
Sums	768	68	45	66	71	56	51	45	53	85	88	57	83

As many of the earthquakes of California are very local phenomena, which depend upon local causes for their production, we cannot expect to obtain very definite laws from a table like this, which covers the whole of such a vast territory. Moreover, the facilities for gathering information in the thinly settled portions of the State were imperfect in the earlier years, and even now shocks are not carefully recorded at more than two or three places in the State. For these and other reasons, this table can only give approximate results. It does not include every single earthquake set down in the catalogue; since it was compiled before the list was entirely finished. It, however, contains nearly all. It is sufficiently full for its purpose, which is simply to show the relative frequency of shocks in the various months. This is for :

1850-1887.	January.....68	182, near Vernal Equinox (1850-1887). (Rainy Season.)
	February...45	
	March.....66	
	April.....71	
	May.....56	152, near Summer Solstice (1850-1887). (Dry Season.)
	June.....51	
	July.....45	
	August.....53	
	September...85	226, near Autumnal Equinox (1850-1887). (Dry Season.)
	October.....88	
	November...57	
	December...83	
	January.....68	208, near Winter Solstice (1850-1887). (Rainy Season.)

Rainy season, 390; dry season, 378. Thus for California, Oregon and Washington at large, shocks are about equally probable in the wet and in the dry season. Table A includes the data derived from observations at San Francisco. If we form a similar table which includes all the data for California, Oregon, etc., *excluding* San Francisco, the result will be, for:

1850-1887.	January....43	119, near Vernal Equinox. (Rainy Season.)
	February...23	
	March.....40	
	April.....56	
	May.....39	105, near Summer Solstice. (Dry Season.)
	June.....34	
	July.....32	
	August.....42	
	September...64	159, near Autumnal Equinox. (Dry Season.)
	October.....53	
	November...27	
	December...61	
	January....43	131, near Winter Solstice. (Rainy Season.)

Rainy season, 250; dry season, 264. (See the last column of Table B.)

LIST OF RECORDED EARTHQUAKES.

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TABLE (B.) OF THE NUMBER OF EARTHQUAKES WHICH HAVE BEEN RECORDED
IN EACH MONTH OF EACH OF THE YEARS 1850-1887 IN SAN FRANCISCO.

YEAR.	Total	January	February	March	April	May	June	July	August	September	October	November	December	Total in California except S. F.
1850	5	1	1			1	1			1				3
1851	10					2	1					4	3	5
1852	1											1		5
1853	5	1		1								2	1	17
1854	8	1	1	1	2	1					2			14
1855	3								1		1		1	11
1856	10	4	1	2		1			1		1			15
1857	17	1	1	2				1		2	2	5	3	14
1858	7		1						2	3		1		3
1859	8								1	2	1	2	2	11
1860	9	1	1		2	1				2		1	1	11
1861	4			1	1		1	1						7
1862	2									1			1	17
1863	8	1					1	2	1				3	9
1864	16		1	3		2	2	3		3	1		1	6
1865	23	1	2	4	3	1			1		9	1	1	19
1866	9	1	2	1		1	1	1					1	15
1867	2	1								1				4
1868	14			1		1		1			7	3	1	40
1869	10	2	2		1	2	3							21
1870	8	1	3	4										11
1871	2		1		1									17
1872	5			1					1		3			36
1873	4		2		1							1		11
1874	6	2		1		1	1						1	4
1875	8		1				3				1	3		9
1876	2	1								1				5
1877	2					1			1					14
1878	4		1							2		1		13
1879	1		1											7
1880	4				1	1	1					1		22
1881	5	1								1	1	2		18
1882	9			1	1		1	2	1	3				17
1883	6	1		1	1						3			22
1884	5	1		2	1			1						22
1885	5	2									1	1	1	34
1886	7	1				1	1	1			1	1	1	5
Sums.	254	25	22	26	15	17	17	13	11	21	35	30	22	514

The number of shocks recorded at San Francisco in the separate months (1850-1887) are:

1850-1887.	January	25	63, near Vernal Equinox. (Rainy Season.)
	February	22	
	March	26	
	April	15	
	May	17	47, near Summer Solstice. (Dry Season.)
	June	17	
	July	13	
	August	11	
	September	21	67, near Autumnal Equinox. (Dry Season.)
	October	35	
	November	30	
	December	22	
	January	25	77, near Winter Solstice. (Rainy Season.)

Rainy season, 140; dry season, 114. Shocks are considerably more frequent in the rainy season than in the dry, contrary to the rule for the State at large. The average number of shocks per month is $\frac{21}{8}$. January, March, October, and November have decidedly more shocks than the average; April, July, and August have decidedly fewer than the average.

If the various shocks in San Francisco are in general due to one and the same cause, and if a general uniformity of action can be predicated of this cause (as yet unknown) then we may say that the probability of a shock in October or November is very considerably greater than that for a shock in July or August.

A comparison of the monthly totals for San Francisco and for California (excluding San Francisco) seems to indicate that the causes of the San Francisco earthquakes are local and not general in their nature. The records from which this table has been derived are so full that considerable weight must be allowed to the conclusions drawn from it.

LIST OF RECORDED EARTHQUAKES.

15

TABLE (C.) OF THE NUMBER OF EARTHQUAKES WHICH ARE RECORDED IN EACH MONTH OF THE YEARS 1850-1887, IN SAN JOSÉ AND SANTA CLARA.

YEAR.	Total	January	February	March	April	May	June	July	August	September	October	November	December	Shocks in S. F.
1850	3			1		1				1				5
1851	0													10
1852	0													1
1853	2											2		5
1854	0													8
1855	0													3
1856	1		1											10
1857	4	1			1						1	1		17
1858	3									2		1		7
1859	4				1				2				1	8
1860	0													9
1861	0													4
1862	0													2
1863	3							2					1	8
1864	5		1	1				1		1			1	16
1865	4										4			23
1866	9		1									1		9
1867	0													2
1868	1										1			14
1869	4		1	1	1		1							10
1870	1		1											8
1871	1		1											2
1872	1			1										5
1873	3		1						1				1	4
1874	1								1					6
1875	2										1	1		8
1876	2	1									1			2
1877	0													2
1878	1										1			4
1879	0													1
1880	2					1						1		4
1881	1											1		5
1882	0													9
1883	0													6
1884	1			1										5
1885	2							1					1	5
1886	0													7
Sums.	61	2	7	5	3	2	1	4	4	4	9	8	5	254

The data for San José and Santa Clara are far less full than for San Francisco. Probably an equal number of shocks has occurred at each place, but the records of San Francisco (which are well kept) show about four times as many shocks as are shown by the San José records (which have not been carefully kept).

The distribution of shocks in the various months is as follows, for:

1850-1887.	January.....	2	} 15, near the Vernal Equinox. (Rainy Season.)
	February.....	7	
	March.....	5	
	April.....	3	
	May.....	2	} 7, near the Summer Solstice. (Dry Season.)
	June.....	1	
	July.....	4	
	August.....	4	} 17, near the Autumnal Equinox. (Dry Season.)
	September.....	4	
	October.....	9	
	November.....	8	} 15, near the Winter Solstice. (Rainy Season.)
	December.....	5	
	January.....	2	

Rainy season, 30; dry season, 24. Like San Francisco, and unlike California at large, there seem to be more shocks in the rainy season.

The average number of shocks per month is $4\frac{1}{2}$ divided by 37.

February, October, and November have decidedly more shocks than the average; January, May, and June have decidedly fewer than the average. July and August have (unlike San Francisco) the average number of shocks. If the data are sufficient to draw any conclusion from, which very probably they are not, this would show that the shocks at San José are local, and that they are, in general, not dependent upon the same cause as those of San Francisco.

Similar tables can be formed for the places where the catalogue shows shocks to be relatively frequent, as Humboldt, Los Angeles, Oakland, San Diego, Monterey, Santa Cruz, Sacramento, etc., and, so far as the data are sufficient, the same result will be found, namely, that the light earthquakes common in California are usually rather local than general and widespread phenomena. A curious example of this is the exemption of Santa Barbara from shocks in the years 1860-1872. Before 1860 and after 1872 Santa Barbara was subject to shocks, precisely as other places in the same region, while between these years no shock is recorded.

The immediate and practical conclusion to be drawn from these tables is that in any future study of California earthquakes we ought to select special regions for examination, as the Valleys of Santa Clara, Napa, San Joaquin, Salinas, Amador, Clear Lake, Pitt River, etc., rather than to attempt a wider range. It may thus be possible to fix the origin of the local shocks, and finally to be reasonably certain of its permanency. It also appears to me that the data seem to indicate that the greater number of California earthquakes have been the result of faulting in the underlying strata rather than due to volcanic causes directly.

From the report of United States Surveyor-General HARDENBURG, for the year ending June 30, 1871, the following is extracted:

"The shocks of 1800, 1808, and 1812 appear to have been about equal in force to the shock of 1868 (and it seems there have been no shocks during a century of greater severity).

"It is fair then to consider the shock of 1868 as a standard of the maximum force of earthquakes occurring in California during the last one hundred years. On the hypothesis that earthquakes are the results of natural laws, which operate with some degree of regularity, it may be fairly presumed that a period of one hundred years would, in all probability, give the extreme limit of the result of the action of these laws. Hence, having learned from reliable history and from observation the maximum strength of earthquakes occurring in California during a century past, we may, from these data, with some degree of confidence predict what their maximum strength will probably be during the hundred years to come. It will perhaps be no difficult matter to provide against any serious damage from these unwelcome visitors, by so constructing buildings that they shall be proof against any such shock of earthquake as has occurred in California during the last hundred years. Reasoning from the foregoing historical facts, I am firmly of the opinion that the earthquakes of California are not so much to be dreaded as is generally supposed; in fact, that they are far less dangerous to life and property than are the hurricanes of the South, or the summer tornadoes of the North."

The earthquake of 1872, which occurred subsequent to the writing of this report, was far more severe than the shock of 1868, and should be taken to represent the maximum severity of any shock *which has actually occurred* in California during a century.

The *destructive* earthquakes in California during the years 1769 to 1887 have been those of:

- 1800. October 11-31 (San Juan Bautista, etc).
- 1812. October or December (San Juan Capistrano).
- 1818. ? (Santa Clara).
- 1836. June 9 and 10 (Monterey and northward).
- 1839. ? (Redwood City and San Francisco).
- 1857. January 9 (Ft. Tejon, Tulare, etc.).
- 1865. October 8 (San Francisco, etc.).
- 1867. January 8 (Klamath, etc.).
- 1868. October 21 (San Francisco, etc.).
- 1872. March 26 (Inyo County).

Say, eleven destructive shocks in one hundred and eighteen years, or one every eleven years on the average, taking the whole State together.

Extremely severe shocks have occurred:

- 1806. March 24 (Santa Barbara).
- 1812. December 21 (San Buenaventura).
- 1843. June 23 (California and Mexico).
- 1851. May 15 (San Francisco, etc.).

LIST OF RECORDED EARTHQUAKES.

- 1852. November 9 (San Diego, Yuma, etc.).
- 1853. February 1 (San Luis Obispo County).
- 1853. October 23 (Eureka).
- 1855. January 24 (Sierra County).
- 1855. July 10 (Los Angeles County).
- 1856. January 2 (San Francisco).
- 1856. January 10 (Los Angeles County).
- 1856. February 15 (San Francisco).
- 1856. In the fall (Tulare County).
- 1856. December (San Diego County).
- 1858. November 26 (San José).
- 1861. July 3 (Amador).
- 1864. March 5 (Petaluma).
- 1865. May 24 (San Francisco).
- 1866. February 17 (Klamath).
- 1868. September 26 (Ukiah).
- 1869. October 8 (Ukiah).
- 1869. December 26 (Sacramento, Marysville).
- 1873. November 22 (Oregon and Washington Territory).
- 1885. January 30 (Honey Lake Valley).

That is twenty-four exceptionally heavy shocks (exclusive of what I have called destructive shocks) have occurred since 1800, say, or one every four years on the average, taking the whole State together. For any particular locality the number of really heavy shocks is quite small. Thus, at San Francisco there have been three destructive shocks and four exceptionally heavy earthquakes in one hundred years, while there have been very many slight shocks and tremors.

If we confine our attention to any other particular part of the State, the number of really heavy shocks occurring there is very few indeed.

When we take into account the whole damage to life and property produced by all the California earthquakes, it is clear that the earthquakes of a whole century in California have been less destructive than the tornadoes or the floods of a single year in less favored regions.

EDWARD S. HOLDEN.

LIST OF RECORDED EARTHQUAKE SHOCKS

IN

CALIFORNIA, LOWER CALIFORNIA, OREGON AND
WASHINGTON TERRITORY (1769 TO 1887).

- 1769. April 11;**
San Diego, Cal.—H. H. B.
- 1769. July 28;**
Four violent shocks in the Los Angeles region. Many more shocks were felt during the following week.—H. H. B.
- 1770.**
At San Gabriel; which was called *El Valle de los Temblores* by Father JUNIPERO SERRA in a manuscript of 1778.—B. Ms.
- 1790?**
The Indians state that about eighty years before the shocks of 1872, March 28, in Inyo County, a similar earthquake occurred in the same region.—B. Ms. *Alta*, April 6, 1872.
- 1800. October 11 to October 31;**
There were shocks from the eleventh to the thirty-first of October, sometimes six in a day, the most severe on the eighteenth, at San Juan Bautista.—H. H. B. Shocks October 11, another October 18, "at supper time," and another at about 11 p. m. of the same day.—J. B. T., *Register*.
- 1800. November 22;**
A shock in Southern California.—H. H. B.
- 1803. April;**
San Gabriel, Cal.—T. H. H.
- 1803. May 25;**
An earthquake damaged the Mission Church at San Diego slightly.—H. H. B.
- 1806. March 24; midnight.**
The church walls at Santa Barbara were cracked.—B. Ms. T. H. H. mentions a shock in March, with no date.
- 1808. From June 21 to July 17;**
There were twenty-one shocks at the Presidio of San Francisco.—TRASK, *Register*, p. 7.—H. H. B. and T. H. H. say eighteen. Adobe walls were seriously damaged.—B. Ms. The first translator of Argüello's communication to the Governor raised the number eighteen to twenty-one, and all the rest have repeated the error.—H. H. B.
- 1812. May;**
Southern California was subject to nearly continuous shocks for four and one half months. Four days seldom elapsed without at least one shock. The inhabitants abandoned their houses and lived out of doors.—TRASK, *Register*, p. 7.

1812. September, October, or December? Sunday?

Fatal earthquake. At San Juan Capistrano the church was destroyed, with loss of life (thirty to forty-five persons). The Mission Church at Santa Inez, near Santa Barbara, one hundred and seventy miles from San Juan Capistrano, was completely destroyed and some lives lost.—J. B. T., *Register*. A Spanish ship at anchor, thirty-eight miles from Santa Barbara, was injured by the shock.—J. B. T., *Register*. The year 1812 was ever after known as *el año de los temblores*.—H. H. B. See letter of Lieut. E. O. C. ORD, U. S. A. (November, 1849), in Tyson's Report, Geology of California, p. 125, where, however, it is called the shock of 1814. October 8, between 7 and 8 A. M., is the day of the great earthquake which destroyed the church of San Juan Capistrano, according to a careful article in the San Francisco *Bulletin*, March 5, 1864. This date is often fixed in September or on December 8. The *Sundays* were: September 6, 13, 20, 27; October 4, 11, 18, 25; November 1, 8, 15, 22, 29; December 6, 13, 20, 27.

1812. October 8;

Shocks for forty days at San Juan Capistrano.—B. Ms.

1812. October 21;

Specially hard shock at San Juan Capistrano.—B. Ms.

1812. December 8;

From San Diego to Purisima; most severe at San Juan Capistrano. It is not clear that it was felt at either San Diego or at San Luis Rey. At San Gabriel the church was badly cracked and lost the top of the tower.—H. H. B.

1812. December 21;

At San Fernando the church received serious damages. At San Buenaventura, three heavy shocks before January 1. At Santa Barbara, a long series of shocks, beginning on the 21st and lasting several months.—H. H. B.

Santa Inez; two shocks, fifteen minutes apart, beginning at 10 A. M. At Purisima, at 10:30 A. M., December 21, the earth shook for four minutes so violently that it was difficult to stand. Half an hour later another more violent shock. A succession of light shocks this day and the next.—H. H. B.

P. GIL reported that there was a huge earthquake wave at sea. A stick with a pendant ball was set up at the Mission (Santa Barbara), and the ball vibrated continually for eight days, and later, at intervals for fifteen days. A ship at Refugio was carried up a cañon by the wave and returned to sea.—H. H. B.

Several asphaltum springs formed in the mountains and tulares; gaps in the Sierra; the "shore volcano" has more openings, and another is reported behind the Sierra de los Pinos.—H. H. B. [? ?]

1812.

San Francisco. Señora JUANA BRIONES relates that, in 1812 the earthquakes were so severe as to cause tidal waves which covered the ground where the plaza now is.—(Communicated by J. R. JARBOE, Esq.)

1813 or 1815;

JOHN GILBOY says an earthquake shook down all the buildings "in the region" (probably Santa Clara Valley) in one of these years.—B. Ms.

1815. January 18;

Five shocks at Santa Barbara.—H. H. B.

1815. January 30;

More shocks at Santa Barbara.—H. H. B.

1815. July 8, 9;

Six shocks at Santa Barbara.—H. H. B.

1818.

The church of Santa Clara was damaged.—T. H. H. "I think there is no authority for such a statement."—H. H. B., vol. 14, p. 377. A new Mission church had been contemplated in 1818. It is said that the old church was so badly injured by an earthquake in 1822 that it was best to take it down; and that a new church (now standing) was built in 1825-6. "For various reasons (which are given) I suppose nothing of the kind to have occurred. As a mere conjecture, it may be that after the church was completed, or nearly so, in 1818 it was damaged by an earthquake, and not fully repaired until 1822."—H. H. B., vol. 14, p. 602.

1821. January 1;

A severe shock at San Buenaventura and San Luis Rey, Cal.—H. H. B.

1824.

There are newspaper accounts of earthquakes in 1824.—H. H. B.

1829. September;

Several very severe shocks of earthquake were experienced in San Francisco, Cal.—*Annals of San Francisco*.

1830.

The Church of San Luis Obispo was injured.—T. H. H.

1836. April 25; 5 a. m.

Monterey, Cal.—H. H. B.

1836. June 9 and 10;

Severe shocks from Monterey northward.—H. H. B.

1836.

An earthquake comparable with the shock of 1868, October 21, was felt in the same region of country; great fissures were made in the earth, and the shocks continued for a month.—B. Ms.

1838. June and July;

Shocks at San Francisco, San José, Santa Clara, and Monterey, Cal.—H. H. B. Very severe in the harbor of San Francisco.—Verbal account of Don José THOMPSON.

1839. ?; shortly after 12 m.

Where Redwood City now is. Destructive. Adobe walls seven feet thick were cracked from top to bottom. The earth was cracked in many places, and one immense fissure extended from Lone Mountain (?) to the Mission San José.—B. Ms.—*San Francisco Call*, December 21, 1879.

1839. ?;

A very severe earthquake in San Francisco, Cal.—*Annals of San Francisco*.

1840. January 16-18;

An earthquake and tidal wave at Santa Cruz. The church tower overthrown.—H. H. B.

1841. May 12; 9 p. m.

A very short, slight shock at Monterey, Cal.—DUFLLOT DE MOFRAS, *Exploration de l'Oregon*.—R. M.

1841. July 3; 2h. 7m. p. m.

A shock at Monterey, Cal. Felt at sea.—DUFLLOT DE MOFRAS, *Exploration de l'Oregon*.—R. M.

1841.

Violent eruptions of Mt. Raynier, Oregon.—PERREY. [?]

1841. Summer;

Monterey, Cal. "The shocks of one hundred and twenty earthquakes were felt during two successive months of * * * summer. The average, however, of two earthquakes a day is not so frightful as it looks, the shocks being seldom severe and often so slight as to escape the notice of the uninitiated stranger."—SIMPSON'S *Journey Round the World*, vol. I, p. 344.

1842. September 28;

Eruption of Mt. St. Helens, Oregon.—PERREY. [?]

1842. November 23;

Eruption of Mt. St. Helens.—PERREY. (1843?) [?]

1842.

Eruption of Mt. Baker, W. T.—PERREY. [?]

1843. June 23; 3:30 p. m.

Very severe earthquake in California, which extended to Mexico.—PERREY.

1843. November 23;

Eruption of Mt. Raynier.—PERREY. (See 1842, November 23, and 1841.) [?]

1843.

Eruption of Mt. Baker, Oregon.—PERREY. [?]

1846-52; exact date not given.

In Oregon City, on Rock Creek, near Portland, Oregon, explosions like those of a cannon were heard for nearly the whole of a day. At first these were about half an hour apart; then they came nearer together, until at last they were no further apart than one minute or so; finally they died away. The water in Rock Creek did not run for three days.—Verbal account of GEO. J. AINSWORTH, Esq.

1848. January 4;

Slight shock at Los Angeles.—B. Ms.

1849. September 16; evening.

At Santa Isabel, between San Diego and the mouth of the Rio Gila.—PERREY.

1849. September 22; 3 p. m.

Twelve miles from Curisco Creek, in the desert between Santa Isabel and the Gila.—PERREY.

1850-1854.

"A Recent Volcano in Plumas County, Cal.," by Dr. H. W. HARKNESS. Dr. HARKNESS describes his visit to a spot near the borders of Lassen and Plumas Counties, directly across the northern end of Snag Lake (Lake Anna), twelve miles east of Lassen's Butte, and gives his own observations, showing a recent eruption, together with the evidence of other persons, all going to prove an active eruption about 1851.—*Proc. Cal. Acad. Sci.*, vol. 5, pp. 408-412.

1850. January 16; 11h; 2h. a. m. ? p. m.?

San Francisco, three shocks.—PERREY.

1850. February 15;

Several shocks, San Francisco, Cal.—PERREY.

1850. March 21;

A light shock in San José, Cal.—J. B. T.—PERREY.

1850. May 13;

San Francisco and San José; also slight eruption of Mauna Loa.—J. B. T. PERREY says: "In March and then May 12 and 13, six shocks in San José and San Francisco during eruption of Mauna Loa."

1850. June 28;

A light shock in San Francisco, Cal.—J. B. T.—PERREY.

- 1850. August 4;**
Stockton and Sacramento, smart shock.—J. B. T.—PERREY.
- 1850. August 15;**
San Diego, Cal., and on the Gila.—PERREY.
- 1850. September 14;**
Smart shock in San Francisco and San José.—J. B. T.—PERREY.
- 1851. March;**
Several shocks in this month in California.—PERREY.
- 1851. April;**
Shocks in California during April.—PERREY.
- 1851. May 13;**
San Francisco and Salinas.—PERREY.
- 1851. May 15; 8:10 a. m.**
San Francisco.—T. T.—J. B. T.—8:20 A. M.—PERREY. Coincident with an eruption of Mauna Loa. Severe shock, lasting about half a minute, felt by shipping in the harbor. Bottles were thrown from shelves to the floor.—B. Ms. PERREY says three shocks, in *Mém. Cour.*, vol. 8, p. 28.
- 1851. May 17;**
A slight shock in San Francisco, Cal.—J. B. T.—PERREY.
- 1851. May 28;**
A slight shock on the Salinas, Cal.—J. B. T.—PERREY.
- 1851. June 13;**
Smart shock in San Francisco, San Luis Obispo, and San Fernando, Cal.—J. B. T.—PERREY.
- 1851. November 12; 7 p. m.**
San Francisco, Cal.—PERREY. Severe.—B. Ms.
- 1851. November 13; 7 p. m.**
San Francisco; motion of the waters in the bay.—PERREY.
- 1851. November 15; 2 a. m.**
San Francisco, Cal.—PERREY.
- 1851. November 15; 10 p. m.**
San Francisco.—PERREY. Also, T. T.
- 1851. November 26;**
Coast of California from $+37^{\circ}$ to $+40^{\circ}$ latitude, eleven shocks.—PERREY.
- 1851. December 2;**
A shock at Downieville, Sierra County, Cal.—J. B. T.—PERREY.
- 1851. December 26; 7 and 8:10 p. m.**
Two light vibrations in San Francisco.—T. T. "One shock in the morning, one at 20 minutes before 10 at night, and one at 35 minutes past 11."—B. Ms. Three shocks: "The first quite severe, at about 3 o'clock (A. M. ?); next about 10 (P. M. ?); last about noon."—B. Ms.—*Alta*, December 26, 1851. During the past two years the direction of the shocks has been invariably from north to south.—B. Ms.—*Alta*, December 28, 1851.
- 1851. December 30; 3 a. m.**
San Francisco.—PERREY.
- 1851. December 31; 3 a. m.; 9:35 a. m.; 11:40 a. m.**
Three shocks at San Francisco.—PERREY. (See December 26.)
- 1851. December 31;**
Smart shock at Downieville, Sierra County, Cal.—J. B. T.

1852. April 12; midnight.

San Diego, Cal.—PERREY.

1852. October 26;

Eleven shocks at San Simeon; an equal number at Los Angeles and San Gabriel. Felt also at San Luis Obispo, San Diego, and Colorado River. During the next six days all the southern part of California shaken at short intervals.—PERREY.

1852. November 9;

Violent shock at Fort Yuma. The shocks continued almost daily for many months. The first shock threw down a portion of Chimney Peak and opened fissures and cracks in the clay desert bordering the Colorado. A small mud volcano was found in an active state about forty miles southwest of the post.—Report of Exp. for Pacific Railroad. Vol. V., p. 115. See HIRTELL'S Resources, p. 44.

1852. November 20;

In Southern California, beginning of a series of thirty-two shocks.—PERREY.

1852. November 22; 11 p. m.

Severe shock eight miles southeast of San Francisco. Next morning a fissure half a mile wide and three hundred yards long was discovered through which the waters of Lake Merced were flowing to the sea.—B. Ms.—*Alta*, November 27, 1852; also November 28.

1852. November 23; a little before midnight.

Shock in California, accompanied by thunder and lightning.—PERREY.

1852. November 24;

San Francisco, Cal. PERREY says the waters of Lake Merced disappeared. (See November 22.)

1852. November 26;

Eleven strong shocks at San Simeon, Los Angeles, and San Gabriel, Cal.—J. B. T. PERREY says November 20 was the beginning of a series of thirty-two shocks in Southern California.

1852. November 27-30;

Continued shocks disturbing an area of over three hundred miles square, extending east from San Luis Obispo to the Colorado River, and north to San Diego.—J. B. T. The shocks opened fissures at least thirty miles long in Lockwood Valley.—Verbal account of J. DE B. SHORB, Esq.

1852. November 29; about noon.

San Diego. Shock lasted about two minutes. "The earth seemed to vibrate to and fro some five or six inches." This shock was followed by lighter ones about sunrise, for several days.—B. Ms.

1852. November 29; 12:20 p. m.

Fort Yuma and San Diego.—PERREY.

1852. December 5; about 11 p. m.

Fort Yuma.—PERREY.

1852. December 17;

Two smart shocks at San Luis Obispo, Cal.—J. B. T.—PERREY.

1852. December;

During the month of December the southern and middle portions of California were much disturbed, and the effects were felt as far north as the thirty-seventh parallel. The shocks continued into the month of January, and were noticed until the fifth of this month on the San Joaquin.—J. B. T.—PERREY.

1852. December 26;

Los Angeles, Cal.—PERREY.

1852.

Fort Yuma. Eruption of a mud-volcano in the Colorado Desert.—PERREY, *Mém. Cour.* 13, p. 19.

1853. January 1;

San Gabriel.—B. Ms.

1853. January 2;

Moderate shock in San Francisco, Bodega, and Shasta City, Cal.—J. B. T.—PERREY.

1853. January 5;

San Joaquin; Corte Madera.—J. B. T.—PERREY.

1853. January 10;

At Captain DANA's rancho, San Luis Obispo County, Cal.—B. Ms. *Alta*, February 24, 1853.

1853. January 29;

Santa Barbara, Cal.—PERREY.

1853. January;

Shocks at San Luis Obispo, Cal.; also at Mariposa and San Francisco.—PERREY.

1853. February 1; 1 p. m.

Violent shocks at San Simeon, San Luis Obispo County. Houses were injured.—B. Ms.—*Alta*, February 24, 1853.

1853. February 14;

San Luis Obispo.—J. B. T.—PERREY.

1853. March 1;

Smart shock at San Francisco, San Luis Obispo, and Santa Barbara.—J. B. T.—PERREY.

1853. April 24;

Light shock at Humboldt Bay, Cal.—J. B. T.—PERREY.

1853. April 25; 26 ?

Three light shocks at Weaverville, Trinity County, Cal.—J. B. T.—April 26—PERREY. April 26—B. Ms.

1853. June 2; at night.

San Francisco, Cal.—B. Ms.—PERREY.

1853. June 2;

Two smart shocks in the plains of the San Joaquin.—J. B. T.—PERREY.

1853. July 12;

A light shock in Yreka, Siskiyou County, Cal.—J. B. T.—PERREY.

1853. July 12;

Saint Joaquin, Cal.—PERREY.

1853. September 27 or 28;

Four shocks in Salinas and San Joaquin Plains.—J. B. T. September 2? —PERREY. September 2?—B. Ms.

1853. October 2;

St. Joaquin, Cal.—PERREY. [Possibly this refers to September 2 q. v. E. S. H.]

1853. October 23;

Three heavy shocks at Humboldt Bay, Cal.—J. B. T. At Eureka it is said the houses rolled like ships at sea and the wharf sank 4 feet.—B. Ms. Also at Acapulco, Mexico, and Peru.—PERREY.

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- 1853. October 25;**
A light shock at Humboldt Bay, Cal.—J. B. T.—PERREY.
- 1853. November 16;**
A light shock at San José, Cal.—J. B. T.—PERREY.
- 1853. November 18;**
Slight shock at San José.—B. Ms.
- 1853. November 20; 11 p. m.**
San Francisco, Cal. More than thirty shocks since January 1.—PERREY.
- 1853. November 21;**
A shock at San Francisco, Cal.—J. B. T.—PERREY.
- 1853. November 23;**
Shasta, Cal.—PERREY.
- 1853. November 25;**
San Francisco.—PERREY.
- 1853. December 11;**
San Francisco and Mission Dolores.—J. B. T.—PERREY.
- 1853. December 23;**
A light shock at Shasta City, Cal.—J. B. T.—PERREY.
- 1853. December;**
Many shocks in Fort Yuma region; geysers formed.—B. Ms.—Also
Second Annual Report of State Mineralogist of California, 1880-2, p. 233.
- 1853;**
PERREY refers to eruptions of Hood, St. Helens, Mt. Baker, etc.—*Am. J. Sc.*
2d series, v. 20, p. 297, September, 1855.
- 1854. January 3;**
Two smart shocks at Mariposa and Shasta, Cal.—J. B. T.
- 1854. January 9; 3:30 a. m.**
San Francisco, Cal.—T. T.—PERREY.
- 1854. February 5; 6:50 p. m.**
San Francisco, Cal.—B. Ms.
- 1854. March 2;**
A light shock in San Francisco, Cal.—J. B. T.—PERREY.
- 1854. March, about the 16th;**
San Francisco.—PERREY.
- 1854. March 16; night.**
San Francisco, Cal.—PERREY.
- 1854. March 20;**
Stockton, Cal.—J. B. T.—PERREY.
- 1854. March;**
St. Helens, Oregon, in eruption.—PERREY. [?]
- 1854. February-April;**
Mountain of St. Helens, Oregon, was in eruption about February-April.—
PERREY. [?]
- 1854. April 10;**
Two shocks at San Francisco, Cal., 10:30 A. M., and 10:45 A. M., the second the
severest.—B. Ms.—*Alta*, April 11, 1854. More violent at Point Lobos.
—PERREY.

1854. April 10;
Mt. St. Helens still in eruption.—PERREY. [?]
1854. April 14; 10-11 a. m.
Two shocks, San Francisco, Cal.—PERREY.
1854. April 20;
Santa Barbara, Cal.—PERREY.
1854. April 29;
A light shock at Santa Barbara, Cal.—J. B. T.—PERREY.
1854. May 3; 5h. 10m.
Three severe shocks at Santa Barbara, Cal.—J. B. T.
1854. May 13;
Santa Barbara, Cal.—PERREY.
1854. May 23;
A shock at Crescent City, Humboldt County, Cal.—J. B. T. And San Francisco, Cal.—PERREY. 11h. 20m. P. M.—PERREY.
1854. May 29;
Santa Barbara, Cal.—PERREY.
1854. May 31; 4:50 a. m.
Three shocks at Santa Barbara, Cal.—J. B. T.—PERREY.
1854. June 26;
Two light shocks in Placer County, Cal.—J. B. T.—PERREY.
1854. July 10;
Shock at Georgetown, El Dorado County, Cal.—J. B. T.—PERREY.
1854. July 14;
Shock at Georgetown, El Dorado County, Cal.—J. B. T.—PERREY.
1854. August;
Smoke on Mt. Hood.—PERREY.
1854. September 14;
A light shock at Nevada (Cal.?)—J. B. T.—PERREY.
1854. October 2;
Humboldt, Cal.—PERREY.
1854. October 21;
A light shock at Monterey, Cal.—J. B. T.—PERREY.
1854. October 21; 7:30 p. m.
San Francisco, Cal.—T. T. 7:35 P. M.—PERREY. "The severest since 1851."
—B. Ms., *San Francisco Daily Herald*, October 22, 1854.
1854. October 26;
Smart shocks at San Francisco and Benicia, Cal., followed by a sea wave.—
J. B. T.—PERREY.
1854. November 1 ?;
Angel Island.—B. Ms., *Alta*, November 1, 1854; *Nevada Journal*, November 10. A calm sea and no wind at first; then water rose several feet with high waves, lasting half an hour.
1854. November 11; 4½h. p. m.
San Francisco.—PERREY.

1854. December 23;

Violent shock occurred in Japan. In the harbor of Simoda the water was agitated so that its depth varied between 8 and 40 feet. The waves were transmitted across the Pacific and registered on the tide gauges of the United States Coast Survey at San Francisco, Astoria, and San Diego. The velocity of the sea wave was: Simoda to San Francisco, 368 miles per hour, 5.966 miles per minute; Simoda to San Diego, 355 miles per hour.—A. D. BACHE, in *Amer. Jour. Sci.*—PERREY.

1855. January 2; just before 10 a. m.

Two slight vibrations five seconds apart. San Francisco, Cal.—B. Ms.—*San Francisco Golden Era*, January 6, 1855.

1855. January 13; 18h. 30m.

Smart shock at San Benito and San Miguel, Cal. It was also felt at San Luis Obispo.—J. B. T.

1855. January 14; 10 p. m.

Along ninety-four miles of the coast of California.—PERREY.

1855. January 24; 22h.

A heavy shock, lasting seven seconds, was felt at Downieville, Sierra County, Cal. This shock was quite severe at Gibsonville on the north, at Forest City and Minnesota, in Sierra County; and at Orleans Flat and Eureka, Humboldt County; in Nevada County; at Georgetown and Nashville in El Dorado County on the south; and at Keystone Ranch, in Yuba County, on the west.—J. B. T.

1855. February 5; 10 a. m.

A light shock at Wolf Creek, and the northeast part of Nevada County, Cal.—J. B. T.

1855. April 7; 6 p. m.

A light shock at Gibb's Ferry, Trinity County, and as far north as Callahan's Ranch, at the head of Scott's Valley, Siskiyou County.—J. B. T.

1855. June 9; 5 a. m.

Fort Yuma; slight shock. *Report of explorations for railroad near the 32d parallel.* Appendix I, p. 9, vol. VII.

1855. June 25; 14h.

Smart shock at Santa Barbara and north to the Valley of Santa Maria.—J. B. T.

1855. July 10; 9h. 30m.

A light shock at Georgetown, El Dorado County, Cal.—J. B. T.

1855. July 10; 20h. 15m.

Severe shock at Los Angeles. Four shocks were felt in about twelve seconds; two unusually heavy sea waves rolled in at Point San Juan, just after the last shock.—J. B. T.—This shock was accompanied by rain.—B. Ms. Bells at San Gabriel Mission Church thrown down.—B. Ms.

1855. July 13;

Slight shock at Gibsonville, Sierra County, Cal.—*S. F. Daily Herald*, July 23, 1855.

1855. August 12; 9:30 a. m.

A light shock at Georgetown, Cal.; four light shocks at Georgetown from July 10 to August 12, dates not recorded.—J. B. T.

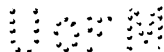
1855. August 26; 1 p. m.

Sonoma County; Petaluma.—B. Ms.—*Sacramento Union*, September 8, 1855.

1855. August 27; 3 p. m.

Violent shock, Sonoma County, Cal.—*Sacramento Union*, September 8, 1855.

1855. August 28;
San Francisco, Cal.—B. Ms.
1855. October 5; 7½ h. p. m.
San Francisco.—PERREY.
1855. October 21; 19h. 45m.
Smart shock in San Francisco. Much commotion in the water of the bay a few minutes preceding the shock.—J. B. T.
1855. October 27; 3 p. m.
A light shock in the Valley of Clear Lake; a light shock at Downieville, Sierra County; more severe shock at Goodyear's Bar.—J. B. T.
1855. December 5; 11:20 a. m.
A shock at Humboldt Bay, Cal.—J. B. T.
1855. December 11; 4h.
San Francisco; quite severe at Mission Dolores—J. B. T.
1855. December 21; 11h. 20m. a. m.
Humboldt Bay, Cal.—PERREY.
1856. January 2; 10h. 15m.
Smart shock at San Francisco, Cal.—J. B. T.—Light shock at 10 A. M.—T. T. "Severe."—B. Ms.—San Francisco *Daily Herald*, January 3, 1856. Goods were shaken from the shelves.—B. Ms. 9 A. M., and 10 A. M.—PERREY.
1856. January 10; 5 a. m.
Slight shock; and another at about 8 A. M., [at San Francisco?] This was very severe at Los Angeles, and throughout the southern part of the State.—B. Ms.
1856. January 21; 16h.
Smart shock in San Francisco, Cal.—J. B. T.
1856. January 23; 4 p. m.
Mission [Dolores?] Cal.—PERREY.
1856. January 28; 3h.
Smart shock at Petaluma, Sonoma County, Cal.—J. B. T.—PERREY.
1856. January 29; 0h. 45m.
Slight shock at San Francisco, Mission Dolores.—J. B. T.—PERREY.
1856. January 31; 4 p. m.
[San Francisco?]—PERREY.
1856. February 15; 5h. 25m. a. m., in S. F.
In San Francisco, severe shock of eight seconds; a previous shock at 2:08 A. M. Heavy shock at Monterey, Cal., 5:20 A. M. Shock at Bodega, Cal. Twenty-two vessels off the coast, from San Pedro to southern Oregon, felt no shock. Shock at Santa Rosa, and no further N.; light shock at Stockton, and no further E.; shocks at San José.—TRASK, *Register*, p. 15.—PERREY. Two shocks in San Francisco, one at 2:15 A. M.; one at 5:23 A. M., lasting twelve seconds. Not felt at Sacramento; slight at Stockton; severe at San José; hardest at Oakland.—B. Ms.—Severe at S. F., 5:35 A. M.—T. T. The water in the Bay of S. F. rose, maintained its level for five minutes, and then sank two feet below its ordinary stage.—B. Ms.
1856. March 15;
San Francisco.—PERREY.
1856. March 24; 22h. 20m.
A slight shock was felt at Canal Gulch, Siskiyou County; also at Yreka.—J. B. T.—PERREY.



1856. March 30; 8:30 p. m.

S. F., Cal.—B. Ms.—*Sacramento Union*, April 2, 1856.—PERREY.

1856. March 31; 12:30 a. m.

S. F., Cal.—B. Ms.—*Sacramento Union*, April 2, 1856.

1856. March 31; 1:30 a. m.

S. F., Cal.—*S. F. Daily Herald*, April 1, 1856.

1856. April 6; 23h. 30m.

Smart shock at Los Angeles, The Monte, Cal.—J. B. T.—PERREY.

1856. April 14;

Los Angeles, Cal.—PERREY.

1856. May 2; 0h. 10m.

Severe shock at Los Angeles.—J. B. T.

1856. May 9; night.

Los Angeles.—B. Ms.

1856. May 10; 21h. 10m.

Light shock at San Francisco.—J. B. T.; and Monterey.—PERREY.

1856. August 2; 5h. 20m.

A light shock in San Francisco, Cal.; more severe at Stockton.—J. B. T.—PERREY.

1856. August 27; 21h. 15m.

Moderate shock, twice repeated, from the west, at Mission San Juan, Monterey, Santa Cruz.—J. B. T.—Another strong shock [where?] in the night of August 29.—PERREY.

1856. September 6; 3h.

Smart shock at Santa Cruz, Cal.—J. B. T.—PERREY.

1856. September 20; 23h. 30m.

Very severe shock in San Diego County, Cal.—J. B. T.—PERREY.

1856. September 22; evening.

San Diego, Cal.; light shock.—PERREY.

1856. September 25; 11:30 p. m.

San Diego County.—B. Ms.—*S. F. Bulletin*, October 18, 1856.

1856. September 28;

Slight shocks in parts of Southern California.—B. Ms.

1856. September 29;

Slight shocks in parts of Southern California.—B. Ms.

1856. October 1;

Slight shocks in parts of Southern California.—B. Ms.

1856. October 18; "morning."

Slight shock at S. F., Cal.—B. Ms.—*Sacramento Union*, October 22, 1856.

1856. November 12; 4h.

Smart shock, Humboldt Bay, Cal. Another shock was reported, but no date given.—J. B. T.—PERREY.

1856. December 26;

Port Townsend, Washington.—PERREY.

1856. December ?; about 10 p. m.

Foot of Clear Lake, Lake County, Cal.—B. Ms.—*S. F. Bulletin*, September 3, 1859. This shock was not felt at Big Valley, thirteen miles away.—B. Ms.

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1856 ? December;

Very severe in San Diego, Cal.—Verbal account of DON JOSÉ THOMPSON.

1856. In the fall.

Tulare County. The line of the shock "was marked by a fracture of the earth's surface, continuing in one uniform direction for a distance of some two hundred miles."—B. Ms.—BARTON, *History Tulare County*, p. 11.

1857. January 8; 11:20 p. m.; also January 9.

Heavy earthquakes in California. All the houses in Santa Barbara were damaged.—PERREY.

At Ft. Tejon this shock was more severe than the shocks of 1812.—B. Ms.—*Nevada Journal*, May 8, 1857. Two persons killed by being buried in the ruins of a house.—B. Ms.—*Los Angeles Express*, December 4, 1875? [1857?] Visalia, Tulare County, it was difficult to stand erect; tree tops waved several feet to and fro; it was equally severe at places within fifty miles, north and south.

1857. January 8; 6 a. m., 9 a. m., 10 a. m.

Three shocks at Santa Barbara, and in the afternoon two slight shocks and one severe one; 8:30 A. M., Los Angeles; 8:15 A. M., San Francisco; 7 A. M., Monterey; 7:30 A. M., Sacramento.—PERREY. San Francisco, 8 A. M.—T. T. At Los Angeles, five or six shocks during the day, and within eight days about twenty shocks.—B. Ms.—*Sacramento Union*, February 5, 1857.

1857. January 8 and 9;

California. Dr. Trask shows that the velocity of the earth wave was: San Francisco-Sacramento; 6.6 miles per minute. San Francisco-Stockton; 6.5 miles per minute. San Francisco-Tejon; 6.0 miles per minute. San Francisco-San Diego; 7.0 miles per minute. Or, on the average, 6.2 miles per minute, or 545.6 feet per second.—*Amer. Jour. Sci.*, vol. 25, p. 146.

1857. January 9; 8:20 a. m.

At Stockton, and Benson's Ferry on the Mokelumne, several shocks on the night 8-9, the principal one at 8:15 A. M.; 8:30 A. M., very severe at Sacramento; 7 A. M., at Los Angeles and Monterey.—*S. F. Bulletin*, January 9, 1857. San José, Cal.—*Sacramento Union*, September 20, 1858.

1857. January 9;

Ft. Tejon, the earth opened in cracks twenty miles long; buildings and chimneys were thrown down; beds of streams changed.—B. Ms.—*Los Angeles County History*, p. 545.

1857. January 9;

Fort Tejon. On ninth January, 1857, an earthquake shook the earth from Fort Yuma to Sacramento. It was most severe at Fort Tejon. A loud rumbling accompanied the shock at Tejon, San Bernardino, Visalia and Mojave Valley. The waters of the Mokelumne River were thrown upon the banks, so as to leave the bed bare in one place. The current of Kern River was turned up stream, and the water ran four feet deep over the bank. The water of Tulare Lake was thrown upon its shores; and the Los Angeles River was flung out of its bed. Some of the artesian wells in Santa Clara Valley ceased to run, and in other places the water increased. Near San Fernando, a large stream of water ran from the mountains, where there was no water before. In San Diego and San Fernando, several houses were thrown down; at San Buenaventura the roof of the Mission Church fell in. Several new springs were formed near Santa Barbara. In the San Gabriel Valley the earth opened several miles long; and in one place the river left its bed and followed the new opening. A large fissure was made in the western part of San Bernardino. At Fort Tejon nearly all buildings were thrown down, large trees overthrown, and the earth opened in a fissure twenty feet wide and forty miles long; the sides then came together with such violence that a ridge was formed ten feet wide and several feet high. At Reed's ranch, near Fort Tejon, a house was thrown down and a woman in it killed.—B. Ms.—HITTELL'S *Resources*, pp. 42-43.

1857. January 16;

Severe shock at Los Angeles.—B. Ms.—5 P. M.—PERREY.

1857. January 17; night.

Two shocks; January 18, 8 A. M.; [at Los Angeles?]-PERREY.

1857. January 18; 9 a. m.

A light shock at Martinez and Benicia, Cal.—J. B. T.—Monterey.—PERREY.

1857. January 20; 8h. 30m. a. m.

Strong shock at Santa Cruz and Mission San Juan, Cal.—J. B. T.

1857. January 20;

Severe shock, Ft. Tejon.—B. Ms.—*Los Angeles County History*, p. 545.

1857. January 20; 3:30 p. m.

Mission San Juan.—PERREY.

1857. January 21; evening.

Smart shock at Mariposa, Cal.—J. B. T.—11 P. M.—PERREY.

1857. February 5; 7 p. m.

San Francisco, Cal.—J. B. T.—T. T. 6:55 P. M. Two shocks at S. F., Oakland, and Stockton, Cal.—PERREY.

1857. March 5; about 7 p. m.

Two short shocks in San Francisco, Cal.—PERREY.

1857. March 14; 15h.

Severe shocks at Santa Barbara and Montecito.—J. B. T.

1857. March 23; 12:27 a. m.

A light shock in San Francisco, Cal.—J. B. T.

1857. April 24?;

A shock was recently felt at San Gabriel and San José, Cal.—PERREY.

1857. May 2; morning.

Two shocks at Los Angeles.—B. Ms.

1857. May 3; 22h.

Smart shock at Los Angeles and The Monte, Cal.—J. B. T.—“Violent shock.”—PERREY.

1857. May 23;

Slight shock at Los Angeles. Severe shock at Fort Tejon.—J. B. T.—“Four shocks at Los Angeles.”—B. Ms.

1857. June 14;

Severe shock at Humboldt Bay, Cal. Several severe shocks at the Penal Island (Carmen), Gulf of Cal.—J. B. T.

1857. July 5; 7h.

Severe shock at San Francisco, Cal.—J. B. T.

1857. August 8; 11h.

Smart shock at Rabbit Creek, Sierra County, Cal.—J. B. T.

1857. August 29;

Severe shock at Tejon Reserve, Cal.—J. B. T.

1857. September 2; 19h. 45m.

Slight shock at San Francisco, Sacramento, Marysville, Nevada, San Juan, Downieville, and Camptonville, Cal.—J. B. T.

1857. September 7;

San Francisco.—PERREY.

1857. September 7;

Violent earthquake in California?? quoted from meteor. observations in 71st report Univ. of N. Y., p. 359, by PERREY, who, however, thinks the date doubtful.

1857. September 14; 2 p. m.

A slight shock in San Francisco, Cal.—J. B. T. At 2:15—T. T.

1857. October 19; 12h. 30m.

Severe shock at San Francisco, Cal.—J. B. T. 6:15 p. m.—T. T.

1857. October 20; 12h. 8m.; 12h. 35m.; 13h. 15m.

Three shocks felt at San Francisco and San José, but not in Oakland; the last the most severe.—J. B. T. Light shock 1:20 a. m.—T. T.

1857. November 2; 6:25 p. m.

S. F., Cal., in the night several light shocks.—PERREY.

1857. November 3; 1:16 a. m. and 3 a. m.

S. F., Cal.—PERREY.

1857. November 8; 3:45 a. m.

San Francisco, Oakland, and Bodega, Cal.—J. B. T.

1857. November 9; 0:45 a. m.

San Francisco, Cal.—T. T.

1857. November 9; 2:30 a. m.

San Francisco, Cal.—T. T.

1857. November 15; a little after 6 p. m.

San José.—B. Ms.

1857. December 23; 7 a. m.

A light shock in San Francisco, Cal.—J. B. T.

1857. December 24; 5:40 a. m.? p. m.?

Four shocks; S. F., Cal.—PERREY.

1857. December 30; 5:40 a. m.

S. F., Cal.—PERREY.

1857.

"Accounts from Fort Tejon report frequent shocks in that section of the country." Dr. TRASK does not mention them in his notes on earthquakes in California during 1857.—PERREY.

1858. January 1 or 2;

San Francisco.—PERREY.

1858. January 13; 9 p. m.

S. F., Cal.—S. F. D.

1858. February 10;

Smart shock at Kanaka Flat, Sierra County, Cal.—J. B. T.

1858. February 15; 4h. 20m.

A light shock in San Francisco, and also in San Mateo County, Cal.—J. B. T.—PERREY.

1858. August 18; 10:45 p. m.

Two shocks, first light, second heavy enough to waken sleepers, Sonoma County.—B. Ms. 10:55 p. m.—*S. F. Directory*.—*Sacramento Union*, August 23, 1858. 10:55 and 10:58 p. m., S. F., Cal.—T. T. "No shock so severe as this in S. F. since February 15, 1856."—B. Ms.

1858. August 19; 22h. 10m.

A light shock in San Francisco.—J. B. T.

34 *LIST OF RECORDED EARTHQUAKES.*

1858. September 2;

Smart shock at Santa Barbara, Cal.—J. B. T.

1858. September 3; 0h. 40m.

Strong shock at San José and Santa Cruz, Cal.—J. B. T.—PERREY.

1858. September 12; 19h. 40m.

Smart shock at San Francisco, Cal.—J. B. T. Lasting 15 seconds.—PERREY.

1858. September 26; 1h. 26m.

A light shock in San Francisco.—J. B. T.—PERREY.

1858. September ?;

San José and elsewhere. In San José more violent than the shock of January 9, 1857.—B. Ms.—*Sacramento Union*, September 20, 1858.

1858. November 26; 12:35 a. m.

San Francisco. "A violent earthquake was experienced in the city this morning at twenty-five minutes before one o'clock. It consisted of two shocks, separated by an interval of a few seconds, and lasting altogether about half a minute. It is considered to have been nearly as violent as the great shock of February, 1856, and to have lasted much longer. A great deal of alarm was occasioned in some of the larger structures of the city, particularly in the Montgomery block, and in the Rasette House, and other extensive hotels. A number of buildings were vacated temporarily. At Musical Hall, where the Independent National Guard were having a ball, the shock was not noticed on the dancing floor, though the building was very much shaken. In the Merchants' Exchange building, opposite the Custom House, some large cracks were made, and a portion of the cornice in the U. S. District Court-room was shaken down. At the City Hall some small pieces of plastering were shaken off, but no serious injury was done; nor, indeed, have we heard of any damage in the city. At the Union Hotel, adjoining the City Hall, the window-blinds were observed to flap violently against the windows, and it was thought by persons in Merchant Street that the building would fall, so violently was it rocked. In many portions of the city bells were rung, and crockery rattled."—B. Ms.—*S. F. Bulletin*, November 26, 1858.

1858. November 26;

San José. "The earthquake was more severely felt at San José than any that has before occurred there. Every family had dishes, glassware, or clocks broken by falling off the shelves or tables. Almost every grocery store had bottles, etc., thrown off the shelves and broken. Every brick, adobe, or concrete building was cracked or injured in some way, or had the plastering broken off. Some plastering was broken off the City Hall. The Jail and Sheriff's office, a two-story brick building, was damaged considerably by the cracking and falling of the plastering. The new Baptist church had the front walls cracked in several places. A new brick building, only one story high, eighteen by twenty feet in size, and very firmly built, was cracked through the center, and had the plastering shaken off. Mr. Minor's concrete building had two corners and a part of the cornice shaken off, damaging it to the extent of about five hundred dollars. Our informant says: "Mr. J. Lewis' large clock was stopped at just eighteen minutes and twenty-two seconds before one o'clock, which must have been the exact time of the commencement of the trembling. He looked at his watch at the conclusion of the shock, when it was just eighteen minutes to one—which would make the duration of the earthquake just twenty-two seconds, if the watch and clock kept the same time. The undulations were from the north to the south, accompanied by a rumbling noise."—B. Ms.—*S. F. Bulletin*, November 27, 1858.

1858. November 26; 0:35 a. m.

Two shocks, San Francisco, Cal.—T. T. 0h. 24m. a heavy shock at San Francisco and Oakland.—J. B. T. Nearly every brick building in San José was injured. The shock at San José was twenty-two seconds long, and begun at 0h. 42m.—B. Ms.—PERREY. This shock was not felt at Stockton, Sacramento, nor Marysville.—J. B. T.

- 1858. December 6; 2 p. m.**
Mariposa, Cal.—PERREY.
- 1859. January 25; 30h. 20m.**
Severe shock in Trinity and Shasta Counties; at Weaverville, Shasta, and Horsetown.—J. B. T.
- 1859. March 21; 5h. 20m. a. m.**
San Diego, Cal.—PERREY.
- 1859. March 25;**
Fourteen shocks, one very severe, at San Felipe, Santa Clara County, Cal.—B. Ms.
- 1859. March;**
Dr. MOGENCRAFT reports an eruption in northern part of Shasta County.—PERREY. [?]
- 1859. April 4; 13h.**
Severe shock at San José, Cal.—J. B. T.
- 1859. April 27; 7:30 p. m.**
San Francisco, Cal., two shocks.—PERREY.
- 1859. August 8;**
San José.—*Sacramento Union*, August 15, 1859.
- 1859. August 10; about 9:30 p. m.**
Heavy shock at San José; after several minutes another slighter.—B. Ms.
—*Sacramento Union*, August 15, 1859.
- 1859. August 10; 23h. 35 m.**
Smart shock in S. F.—J. B. T.—S. F. D.
- 1859. August 15; August 17.**
Eruption of Mt. Hood, Oregon.—PERREY. [?]
- 1859. August 29; 10:30 p. m.**
Three distinct shocks in Mariposa County, Cal.—B. Ms.—*Alta*, September 10, 1859.
- 1859. August;**
Big Valley, Lake County, Cal.—B. Ms.—*S. F. Bulletin*, September 3, 1859.
The shocks were not felt a few miles off. (See 1856, December.)
- 1859. September 9; 9:30 a. m.**
Two distinct shocks. Petaluma, Cal.—B. Ms.—*Sacramento Union*, September 15, 1859. Slight shock S. F., Cal.—B. Ms.
- 1859. September 22; a. m.**
Severe shock, S. F., Cal.—S. F. D.
- 1859. September 24; 3 a. m.**
Slight shock at Half Moon Bay.—B. Ms.—*Sacramento Union*, September 28, 1859. Waters of the bay receded fifteen feet and returned suddenly.
- 1859. September 24; 5:45 a. m.**
San Francisco, Cal.—T. T.
- 1859. September 26; 6h. 10m.**
Smart shock in San Francisco, Cal.—J. B. T.
- 1859. October 5; 0:16 p. m.**
Severe shock at San Francisco, Cal.—T. T.—13h. 8m.; strong shock, S. F., Cal.—J. B. T.—PERREY.—The severest since 1856, February 15.
- 1859. October 18; 6 a. m. (See September 24.)**
S. F.; at Half Moon Bay the water left the bay for several seconds.—PERREY.

- 1859. November 19; 3 a. m.**
Slight shock, S. F., Cal.—B. Ms.—*Sacramento Union*, November 22, 1859.
- 1859. November 22;**
Mt. Baker in full activity.—PERREY. [?]
- 1859. November 25;**
San Francisco, Cal.—PERREY.
- 1859. November 27; evening.**
Two shocks, San Francisco, Cal.—PERREY.
- 1859. November 27; 19h. 15m.**
A light shock in San Francisco, Cal.—J. B. T.
- 1859. December 1; 0h. 50m.**
Smart shock in San Francisco, Cal. Felt at Oakland and Benicia.—J. B. T.—PERREY.
- 1859. December 1; 14h. 10m.**
Several successive shocks were felt at San Bernardino; several of them were quite heavy.—J. B. T.—2:10 P. M.—PERREY.
- 1859. December 6; evening.**
Slight shock at S. F., Cal.—S. F. D.
- 1859. December 11; 9 a. m.**
Smart shock at San José.—B. Ms.—*Sacramento Union*, December 12, 1859.
- 1859. December 24; 0:54 a. m.**
San Francisco, Cal.—T. T.
- 1859. December;**
Eruption of Mt. Baker.—PERREY. [?]
- 1860. January 1; 8:43 p. m.**
Light shock at S. F., Cal.—PERREY.
- 1860. January 26-27; night.**
Los Angeles, Cal.—PERREY.
- 1860. February 9; a few minutes before 1 o'clock.**
S. F., Cal.—B. Ms.—*Sacramento Union*, February 10, 1860.
- 1860. March 15; 11h.**
Violent shock at Sacramento. The wave passed through the counties of Placer, Nevada, El Dorado, and Plumas. The earthquake extended to the eastern base of the Sierra Nevada. At Carson City it occurred at 10h. 45m. and was very violent.—J. B. T.
- 1860. March 26;**
Los Angeles and Southern California, severe.—B. Ms.
- 1860. March 27;**
Severe shock in Los Angeles and vicinity.—J. B. T.
- 1860. April 2; 6 p. m.**
Two severe shocks at San Juan, Monterey County, Cal.—B. Ms.—*Sacramento Union*, April 7, 1860.
- 1860. April 5; 1 a. m.**
Several shocks in S. F., Cal.—PERREY.
- 1860. April 16; 7:30 p. m.**
San Francisco, Fort Tejon, Santa Barbara.—B. Ms.—*Sacramento Union*, May 1, 1860.
7 P. M. Severe shocks at S. F., Cal.—PERREY. April 17? About this time shocks during several hours at Washoe, Nev.—PERREY.

1860. April 19;
Several shocks, S. F., Cal.—PERREY.
1860. April 26.
Eruption of Mt. Baker—PERREY. [?]
1860. May 7;
Port Townsend, W. T.—PERREY.
1860. May 25; about 6 a. m.
Two shocks at S. F., Cal.—B. Ms.—*Sacramento Union*, May 23, 1860.
1860. June 1; evening.
Mariposa.—B. Ms.—*Sacramento Union*, June 9, 1860.
1860. September 23; 10 a. m.
S. F., Cal.—B. Ms.—*Sacramento Union*, September 26, 1860.
1860. September 23; about 9 p. m.
Severe shock at Martinez.—B. Ms.—*Alta*, October 1, 1860.
1860. September 30; 10 a. m.
S. F., Cal.—PERREY.
1860. November 12;
Smart shock at Humboldt Bay, Cal.—J. B. T. Felt in various parts of the country, also.—B. Ms. *Alta*, November 24, 1860.
1860. November 24; 1:30 a. m.
S. F., Cal.—PERREY.
1860. December 21; 6h. 30m.
Repeated slight vibrations, extending over a period of half an hour, noticeable only by the vibrations of the mercury in the barometer. S. F. Cal.—J. B. T. The next day a violent earthquake at Santiago de Chili.—MILNE'S *Earthquakes*, p. 331. Probably no connection between these events.
1861. January 12; about 1 a. m.
Two severe shocks in Trinity County, Cal.—B. Ms. *Sacramento Union*, January 29, 1861.
1861. January 27; 8 a. m.
Butte County, Cal.—B. Ms. *Sacramento Union*, February 4 and February 12, 1861. (Supposed to be an explosion of gunpowder, or of a meteor, or the rumbling of an avalanche. Heard also in Sierra County.)
1861. February 2; 1:30 a. m.
San Francisco, Cal.—PERREY.
1861. March 23; ? a. m.
Quite severe at S. F., Cal.—B. Ms.—*Sacramento Union*, March 25, 1861.
1861. March ?
Tejon, Cal.—B. Ms.
1861. April 29; 4:10 a. m. ? p. m. ?
Slight shock at S. F., Cal.—B. Ms.—*Sacramento Union*, May 2, 1861.
1861. April 29; 9:25 p. m.
Smart shock at Mendocino, Cal.—B. Ms.—*Sacramento Union*, May 11, 1861.
1861. May 4; p. m.
Slight shock in the neighborhood of San Francisco. During this week the tides were unusually low.—PERREY.
1861. June 13; 5:25 a. m.
Slight shock at S. F., Cal.—B. Ms.—*Sacramento Union*, June 15, 1861.

1861. July 2;

Alameda, Cal.—B. Ms.—*Sacramento Union*, July 8, 1861.

1861. July 3; 4:11 p. m.

Severe shock, followed by two light shocks, at San Francisco, Cal.—T. T.
For several days light shocks were felt in and near S. F.—J. B. T.

A light shock in San Francisco, but *very heavy, indeed*, at Doherty's Ranch, in Amador Valley, near where Livermore now is. Verbal account of R. C. Hopkins. Adobe houses seriously injured; men in the fields were thrown down.—HITTELL's *Resources*, p. 43. Stockton, also.—B. Ms.

1861. July 3; 8 a. m.; July 4 and 5, at night; July 7, at night.

Slight shocks in Alameda, Cal.—B. Ms.—*Sacramento Union*, July 15, 1861.

1861. July 4?; 16h. 11m.

Severe shock of earthquake occurred at San Francisco. It consisted of three distinct waves, following each other in very rapid succession. More severe in the San Ramon Valley, east of the city. It opened a large fissure in the earth, and a new spring of water. For several days after there were light shocks.—J. B. T.—PERREY.

1861. September 16; 2 a. m.

Violent earthquake at Sierra Valley, Nevada County, Cal.—B. Ms.—*Sacramento Union*, September 30, 1861.

1861. October 26? November 26?;

Humboldt, Cal.—B. Ms. *S. F. Bulletin*, December 2, 1861, gives the date as October 26; *Sacramento Union* gives November 26. The same shock is referred to by both papers.

1861. December 9;

Sta. Catalina Island.—B. Ms.

1862. January 21; about 5 a. m.

Stockton.—B. Ms.—*Sacramento Union*, January 25, 1862.

1862. March;

Tejon, Cal.—B. Ms.

1862. May 27;

Severe shock in Southern California, San Diego, Temecula, and Anaheim.
—B. Ms.

1862. May 27 to June 5;

Shocks nearly every day.—B. Ms. [In Southern California?? E. S. H.]

1862. June 7;

Los Angeles.—B. Ms.

1862. June 13;

San Diego, Cal.—B. Ms.

1862. June 14;

San Diego, Cal.—B. Ms.

1862. July 2; about 5 p. m.

A severe shock at La Porte, Sierra County, Cal.—B. Ms.—*S. F. Bulletin*, July 11, 1862.

1862. September 28; 7-8 a. m.

In the *Echo du Pacifique* of October 1, two shocks are reported.—PERREY.

1862. September 29; 15h. 5m.

A very smart shock at San Francisco. Felt also at Petaluma.—J. B. T.

1862. October 21;

Violent shock at San Diego, Cal. Seven shocks since May 28.—B. Ms.

1862. December 29? 277; about 5 a. m.
S. F. and Oakland, Cal.—PERREY.
1862. December 23; 20h. 19m.
Smart shock in San Francisco, Cal.—J. B. T.—5:30 A. M.—T. T.—Thunder at 2 A. M.—B. Ms.
1862. December 29;
Slight shock at San Francisco.—S. F. D.
1863. January 17; about midnight.
S. F., Cal.—PERREY.
1863. January 25; 2h. 20m. p. m.
A severe shock at San Diego, Cal.—J. B. T.—B. Ms.—*Alta*, February 11, 1863.
1863. January 25; 5h. 20m.
Severe shock in San Diego, Cal.—J. B. T.
1863. February 1; 16h. 1m.
A very smart shock at the Mission San Juan, Monterey County. At Gilroys, twelve miles east of the Mission, the shock was fifteen minutes later. The shock was not felt at Monterey, twelve miles west of the Mission.—J. B. T.
1863. February 6; 4 p. m.
New Gilroy, twelve miles northwest of San Juan, at 4:15 P. M.; San Juan, Monterey County, 4 P. M.—B. Ms.—*Alta*, February 11, 1863.
1863. March 18; about 2 a. m.
A severe shock in San Francisco, Cal.—S. F. D.
1863. June ?
A smart shock at San Francisco, Cal.—J. B. T.
1863. About June 27; 1:11 p. m.
San Diego.—B. Ms.—*Alta*, July 7, 1863.
1863. July 15; 6:30-8:30 ?
Two strong shocks at San José, Cal.—PERREY.
1863. July 15; 10h. 19m.
Smart shock in San Francisco, Cal.—J. B. T.
1863. July 16;
San José; Santa Clara.—B. Ms.
1863. July 24; about 10 a. m.
A severe shock at S. F., Cal.—S. F. D.
1863. July 31; about 10 a. m.
Strong shock at S. F., Cal.—PERREY.
1863. August 1; 10h. 48m. p. m., and 11h. 6m. p. m.
Two shocks at San Francisco.—J. B. T.
1863. August 2; 11:15 p. m.
Three severe shocks at S. F., Cal.—S. F. D.
1863. October 18;
Yuba City, Sutter County, Cal.—B. Ms.—S. F. *Bulletin*, October 22, 1863.
1863. December 19; 12h. 38m.
A very smart shock, followed by one still more severe, in San Francisco.—J. B. T.

1863. December 19; 2:38 p. m.

Severe shock at S. F., Cal., followed a few seconds later by one more severe. Probably the severest shock since 1855.—B. Ms.

1863. December 19; 2:45 p. m.

Very severe shock at San José and Santa Clara.—B. Ms.—*Alta*, December 20, 1863.

1863. December 23; 2:40 p. m.

Strong shock, 5-6s., in S. F., and San José, Cal.—PERREY.

1863. December 30; about 3 a. m.

Strong shock in S. F., Cal.—PERREY.—Several shocks.—S. F. D.

1864. February 26; 0h. 40m., and 2h. 10m., 5h. 47m.

Shocks in San Francisco, Visalia, San José, and Santa Clara.—J. B. T.—Severe at Santa Cruz.—B. Ms.—Severe in S. F.—B. Ms.—PERREY.

1864. March 5; 8h. 49m.

A shock of considerable violence at San Francisco, Santa Rosa, Santa Cruz, Stockton, Petaluma, Santa Clara, and San José. At the last named place the shock was most violent, and lasted about two minutes. Very severe at Visalia.—J. B. T.—Light shock at S. F., 8:50 A. M.—T. T.

1864. 8:30 a. m.

Tuolumne, Cal.—B. Ms.—*S. F. Bulletin*, March 10, 1864.

1864. March 10; 14h. 6m.

A light shock at San Francisco.—J. B. T.—16h. 30m., a second shock.—J. B. T.

1864. March 11; 9:15 a. m.

Slight shock at S. F., Cal.—S. F. D.

1864. March 20; 23h. 45m.

A light shock in San Francisco.—J. B. T.

1864. March 22; 13h.

Smart shock at Stockton, Cal.—J. B. T.—S. F., Santa Clara.—PERREY.

1864. May 20; 18h. 1m. [6h. 1m. ?]

Slight shock at San Francisco, Cal.; 18h. 10m. severe shock at Stockton; 18h. 57m. severe shock at Napa; 18h. very severe at Sacramento.—J. B. T.

1864. May 20; 5:56 p. m.

Light shock at San Francisco, Cal.—T. T.—Five or six shocks were reported about 6 p. m., very severe.—*Mining and Scientific Press*.—S. F. D.

1864. June 6; 11h. 7m.

A light shock in San Francisco.—J. B. T.

1864. June 22; 20h. 53m.

Smart shock at San Francisco, Cal.—J. B. T.—PERREY.

1864. July 5; 20h. 3m.

Moderate shock at San Francisco, Cal.; four vibrations.—J. B. T.

1864. July 18; 8h. 20m. p. m.

Near Los Angeles, Cal.—PERREY.

1864. July 21; 2h. 7m.

Smart shock in San Francisco.—J. B. T.—Several shocks July 21.—S. F. D.

1864. July 21; 22h. 40m. 38s.

A very smart shock in San Francisco, San José, and Stockton; twelve minutes later in Los Angeles, but not very heavy.—J. B. T.—Not felt at Sacramento.—PERREY.

1864. July 25; 23h. 56m.
Los Angeles, Cal.—J. B. T.
1864. August 1.
San Francisco, San José, Sacramento, Stockton, and Los Angeles.—PERREY.
1864. August 15; 9h. 53m. p. m.
Fort Miller, Fresno County, Cal.; strong shocks.—PERREY.
1864. August 17; 22h. 39m.
A light shock at Nevada, Cal., and vicinity.—J. B. T.—PERREY.
1864. August 18; 5h. 18m.
Very strong, Grass Valley, Cal., and Nevada.—J. B. T.—Marysville, Yuba.—PERREY.
1864. September 6; 10h. 3m.
San Francisco, Cal.—J. B. T.—PERREY.
1864. September 20; 11h. 0m.
San José and S. F., Cal.—J. B. T.—10:45 A. M.—S. F. D.
1864. September 27; 10h. 32m.
Strong shock, Mission San Juan, Monterey County, Cal.—J. B. T.; also at Watsonville.—PERREY.
1864. September 29; 11:20 a. m., ? p. m. ?
San Francisco.—PERREY.
1864. September 30; 10:30 a. m.
San Francisco.—PERREY.
1864. October 6; 21h. 9m.
Smart shock at San Francisco, Cal.—J. B. T.—PERREY.
1864. October 14; 1h. 8m.
Two heavy shocks at Mission San Juan.—J. B. T.
1864. October 14; 10h. 25m.
Heavy shock at Mission San Juan.—J. B. T.
1864. October 18; at night.
San Juan; two shocks.—PERREY.
1864. October 21; 3h. a. m.
Strong shock at San Juan.—PERREY.
1864. October 27; about 10 p. m.
San Francisco, Cal. (Several light shocks.)—PERREY.
1864. October 29; night.
Victoria (Vancouver). Severest shock on record, lasting fifteen seconds. Felt also at New Westminster.—PERREY.
1864. December 11; 20h. 52m. [5h. 52m. ?]
At San Francisco and San José; at the last place one minute later and more severe.—J. B. T.—9 p. m.—S. F. D.
1864. December 18;
Strong shock at Watsonville, Santa Cruz County, Cal.—PERREY.
1865. January 2;
Ukiah, Mendocino County, Cal.—B. Ms.
1865. January 9; 7h.
Smart shock in Santa Rosa, Sonoma County, Cal.—J. B. T.—Fuchs.—PERREY.

1865. January 19; 8h. 8m.

A light shock in San Francisco.—J. B. T.

1865. February 4; 11 p. m.

Strong shock in S. F., Cal.—FUCHS.

1865. February 7; to end of 1866.

It is the opinion of FUCHS (p. 10) that a period of earthquakes in San Francisco, began on February 7, and lasted during the whole of the year 1866, and even into 1867. The greatest shock was 1865, October 8.

1865. February 7; 11 p. m.

San Francisco.—PERREY.

1865. February 8; 2 p. m.

Strong shock in S. F.; another at 6½ p. m.—FUCHS.

1865. March 5; night.

Petaluma; the heaviest ever felt up to this time.—B. Ms.

1865. March 5; 8h. 45m.

A light shock at Visalia, Cal.—J. B. T.

1865. March 7; 11½ p. m.

Heavy shock in Napa City, followed one hour later by a lighter one.—FUCHS. Smart shock at San Francisco at 23h. [11h. ?]—J. B. T.

1865. March 8; 6 a. m.

Heavy shock at Napa City, and half an hour later another shock. In Santa Rosa, six shocks.—FUCHS. Smart shock in S. F., 6h. 20m.—J. B. T.

1865. March 19;

San Francisco.—PERREY.

1865. March 24; 7:30 a. m.

Rather severe shock in S. F., Cal.—FUCHS.

1865. March 30; 7h. 28m.

Very smart shock at San Francisco, Cal.—J. B. T.—PERREY.

1865. April 15; 0h. 40m.

Severe shock at San Diego, Cal.—J. B. T.

1865. April 18; 13h. 31m.

Light shock at San Francisco, Angel Island, and Oakland. Severe at San Juan.—J. B. T.

1865. April 26; 3:55 p. m.

Quite a severe shock in S. F.—*Mining and Scientific Press*. Heavy shocks in many places in California, all from E. to W.—FUCHS.—PERREY. Two shocks S. F., Cal.—S. F. D.

1865. April 27; 15h. 56m.

Shock at San Francisco, Cal.—J. B. T.

1865. May 24; 3h. 21m.

Smart shock at San Francisco, San Juan, and Santa Cruz. At the first place, a single movement; at the second, two waves.—J. B. T.—PERREY.—FUCHS. Light shock at 3:30 A. M.—T. T. Remarkably heavy in Southern California.—B. Ms.

1865. June 12; ?

Several shocks at Victoria, Vancouver Island.—FUCHS.

1865. June 14; 12 m.

Slight shock at S. F., Cal.—S. F. D.

1865. August 25; 9 p. m.

Heavy shock at Vancouver Island, lasting two minutes; later two more shocks.—FUCHS.

1865. August 29; 5 a. m.

Shock in S. F., Cal., from southeast to northwest.—FUCHS.—PERREY.

1865. September 21;

Eruption of Mt. Hood. (Doubtful.)—PERREY.

1865. September 22;

Smart shock at Yreka, Cal.—J. B. T.

1865. September 23;

Mt. Hood in eruption from September 23 to October 8, certainly.—B. Ms. [?]

1865. October 1; 7 a. m.

Heavy shock at Eureka, Cal.—FUCHS. Which destroyed all the brick houses.—PERREY.

1865. October 1; 9h. 15m.

Very smart shock at Fort Humboldt, Cal.—J. B. T.

1865. October 3;

Heavy shock at Eureka, Humboldt County, Cal.—B. Ms.

1865. October 5; ?

Shock in S. F., Cal.—FUCHS.—PERREY.

1865. October 8; 12h. 46m.

Very severe shock at San Francisco, San José, Stockton, Santa Cruz, Sacramento, etc. Most severe shock since the annexation of the territory, and it was followed by a condition of continuous vibration, which lasted for about ten hours.—J. B. T.—T. T. Yolo County.—B. Ms.

1865. October 8; 22h. 1m.

Light shock at San Francisco, San José, Stockton, Santa Cruz, Sacramento, etc.—J. B. T. Another at 23h. 50m.—J. B. T.

1865. October 8;

San Francisco. The first shock was felt at sixteen minutes before one o'clock, and lasted perhaps five seconds. It was almost instantly followed by a heavier shock, which continued for ten seconds or more. The vibrations appeared to be east and west, or northeast and southwest. There was nothing in the weather or in the condition of the atmosphere during the previous week to foretell the earthquake. On October 8, in the evening, there were two or three slight additional shocks. The chief damages to buildings were to Popper's building, Third and Mission Streets, the City Hall, the old Merchants' Exchange, corner Battery and Washington Streets. The latter building was completely ruined. The California Engine Company's House, Market and Sansome Streets, was severely injured and rendered unfit for occupancy. The chimney in the rear of the Lick House was shaken down. Stoddard's warehouse on Beale Street is said to have been thrown out of place several inches. On Third Street, from Market to Howard, the window glass was broken in many places. On Washington Street, also, the glass appears to have suffered from Dupont Street down to Montgomery. On the marshy lands in the vicinity of Howard and Seventh Streets, lamp posts, water pipes, and gas pipes, were broken and thrown out of position. The ground on Howard Street, from Seventh north to Ninth, cracked open, leaving a fissure nearly an inch wide. Not one fatal accident has yet been heard of. The effect of the earthquake on the waters of Mission Bay and on Long Bridge was frightful. The shock was felt severely at San José. About ten feet of the wall of the jail was thrown down, and a portion of the wall of the Methodist church. The bell of the convent was tolled. At Santa Clara nearly all of the brick buildings in town were more or less injured. On the Santa Cruz Gap road chimneys were thrown down and the roads more or less obstructed by stones rolled down from the mountains. At Stockton the shock was very severe. At Visalia and Los Angeles the earthquake was not felt at all.—B. Ms.—S. F. *Bulletin*, October 9, 1865.

1865, October 8. The shock at Sacramento did no damage, although it was severe enough to cause many persons to feel nausea.—B. Ms.—S. F. *Bulletin*, October 11, 1865.

- 1865, October 8. This shock was not felt in the slightest degree at Santa Barbara—at least, not in the vicinity of the town.—B. Ms.—*S. F. Bulletin*, October 17, 1865.
- 1865, October 8. At New Almaden a large brick storehouse on the hill was nearly demolished. Several houses in the village were thrown down. The earth opened and closed again, throwing up great clouds of dust. Two miles out of San José, on the road to New Almaden, the new brick building of Mr. John W. Winters was materially damaged. A number of chimneys in different parts of the county were thrown down.—B. Ms.—*San José Patriot*, October 11; quoted in *S. F. Bulletin*, October 12, 1865.
- 1865, October 8. "The streams at McCartysville and Los Gatos have risen greatly since the earthquake, tapping the sources of the artesian wells in the Santa Clara Valley, many of which have ceased to run since the earthquake."—B. Ms.—*S. F. Bulletin*, October 31, 1865.
- 1865, October 8. At Mountain Charley's, on the Santa Cruz road, the earth opened in several places, and steam and water were thrown up through the cracks. At McCartysville or Saratoga the creek began to rise four hours after the great shock, and increased to about treble the usual quantity of water the creek discharges during the dry season.—B. Ms.—*S. F. Bulletin*, October 21, 1865.
- 1865. October 8;**
At Fort Humboldt, on Sunday morning, October 8, 1865, at fifteen minutes past nine o'clock, there was a very severe earthquake. Fifteen chimneys will have to be completely rebuilt.—*S. F. Bulletin*, October 12, 1865.
- 1865. October 8;**
Goose Lake, Siskiyou County, Cal. Waterspouts observed all over Goose Lake.—B. Ms.—*Yreka Union*, October 28, 1865.
- 1865. October 8;**
Accounts given in BANCROFT'S MS., as follows: *San Francisco Bulletin*, October 9, 12, 1865. *San Francisco Call*, October 10. *Gold Hill News*, October 12. *Sacramento Union*, October 10. HITTELL'S History of San Francisco, p. 354. Shocks felt at Petaluma, but no damage done. *Petaluma Journal and Argus*, October 12. *San Francisco News Letter*, October 14. *S. F. Golden Era*, October 15. (Two articles), *S. F. Californian*, October 14. (In the Interior), *S. F. Alta*, October 10, 11, 14, 16, and 17. *S. F. Alta*, October 9 and 10.
- 1865. October 8;**
From ROWLANDSON, the following is extracted: The shock was certainly felt one hundred miles north of S. F., and one hundred miles east. There is no report of any shock south of Monterey Bay. It is a singular fact that the shock was most severe at Santa Cruz and along the lower part of the Pajaro River. The center of disturbance was probably at the mouth of this river. Mt. Hood was in eruption, and Goose Lake was covered with waterspouts, and ROWLANDSON connects these with the S. F. disturbance. There was no shock felt at any distance from the coast, but boats a few miles from shore felt the shock.
- 1865. October 9; 10h. 34m.**
Light shock in San Francisco, Cal.—J. B. T.
- 1865. October 9; 11h. 32m.**
Light shock at San Francisco. After this shock the earth continued to vibrate for forty-eight hours.—J. B. T.
- 1865. October 12; 12:45 a. m.**
S. F., and Santa Clara, Cal.—B. Ms.—*S. F. Bulletin*, October 13, 1865. Constant tremors in San Francisco.—FUCHS. This Santa Clara shock is stated to have been as heavy as the one felt between 10 and 11 o'clock, October 8.—See also PERREY.
- 1865. October 13; 2h. 5m.**
Smart shock at San Francisco, Oakland, Santa Clara, and Angel Island, Cal.—J. B. T.
- 1865. October 14, 15, 16; night and day.**
Monterey—many shocks.—B. Ms.

- 1865. October 14; 23h. 45m.**
San Francisco, Cal.—J. B. T.
- 1865. October 15; 3h. 40m.**
San Francisco, Cal.—J. B. T. Santa Cruz; Santa Clara.—B. Ms.—PERREY.
- 1865. October 20; 7:55 p. m.**
S. F., Cal.—FUCHS.—PERREY.
- 1865. October 27; 1 a. m.**
Napa City, Cal.—FUCHS.
- 1865. November 24; 3:45 a. m.**
Shocks in S. F. and in Santa Cruz County, Cal.—FUCHS. Smart shock at Watsonville, Santa Cruz County.—J. B. T.
- 1865. November 26; ?**
At sea, between S. F. and Portland, an earthquake.—*Mining and Scientific Press.*
- 1865. December 7; 1h. 15m.**
Light shock in San Francisco.—J. B. T.
- 1865. December 15; 9 p. m.**
Heavy shock at Dry Creek, Mendocino County, Cal.; nine shocks, three being quite heavy.—*Mining and Scientific Press.*
- 1866. January 25; 10:32 a. m.**
Slight shock in S. F., Cal. At 10h. 10m., heavy shock in Sonoma.—FUCHS. Another smart shock in S. F. at 10:40.—PERREY.
- 1866. February 15; 8:45 a. m.**
Slight shock in San José, Cal., followed at 9:10 by a shock covering a greater area.—FUCHS. At 8:57 A. M., two shocks at S. F., Cal.—B. Ms. Two shocks at Santa Clara.—PERREY.
- 1866. February 17;**
"The Klamath River, fifteen miles above the Jacksonville road, was suddenly raised, exposing its bed, while a hill on its bank sunk away to a level plain; on one side of the hill, where it separated from the mainland, it left an abrupt bluff. The river channel was immediately changed, the water running around where the hill had been standing. Bob Whittle, and others, witnessed the phenomenon, and gathered large quantities of fish, that were left in the old bed, when the water drained off."—B. Ms.—*Quincy Union*, March 10, 1866.—*Yreka Journal.*
- 1866. February 18; 4:05 p. m.**
S. F., Cal.—FUCHS.—PERREY.
- 1866. March 26; 12:30 p. m.**
Earthquake from east to west, in S. F., Stockton, Sacramento, San José, etc.—FUCHS. Two shocks.—S. F. D.
- 1866. March 26;**
Quite a severe shock at Monterey.—B. Ms.
- 1866. March 26; 12:12 p. m. (noon).**
Two slight shocks at S. F.—B. Ms.
- 1866. March 27;**
Monterey.—B. Ms.
- 1866. March ?;**
Monterey, Cal.—B. Ms.—*S. F. Golden Era*, March 25, 1866.

1866. April to November;

San José, Cal. An earthquake register, invented by W. F. STEWART, has noted nine distinct shocks in the past seven months. All the shocks were northeast and southwest.—*San José Mercury*, November 8, 1866.

1866. May 24; 9:05 a. m.

Sacramento.—B. Ms.

1866. May 27;

Pacheco, Contra Costa County, Cal.—B. Ms.

1866. May 30; 3:40 a. m.

Heavy shock in S. F., Cal.—FUCHS. Also in Oakland.—B. Ms.—PERREY.

1866. June 5; 6:04 a. m.

Rather heavy shock at S. F., Cal.—FUCHS.—PERREY. Seven shocks.—B. Ms. About 4 A. M.—S. F. D.

1866. June;

Monterey, Cal.—B. Ms.—*S. F. Golden Era*, July 1, 1866.

1866. June;

? —B. Ms.—*Gold Hill News*, June 2, 1866.

1866. July 13; 11 p. m.

S. F., and interior towns.—S. F. D. [Probably same? as July 14.—E. S. H.]

1866. July 14; 10:30 p. m.

Heavy shock in La Porte, Rowland Flat, St. Louis, and Port Wine, Sierra County, Cal.—FUCHS. Also Sacramento and Contra Costa County.—B. Ms. Also in S. F.—B. Ms. Heavy in Sacramento; light in S. F. and Stockton.—PERREY.

1866. August 19; 12:40 a. m.

Shock in Oakland and San Francisco.—*Mining and Scientific Press*.

1866. August 23; 4 p. m.

S. F., Cal.—B. Ms.

1866. During the summer;

A severe sudden shock at Sulphur Bank, Clear Lake, Cal.—Verbal account of R. S. FLOYD, Esq.

1866. September 5; morning.

La Porte, Rowland Flat, St. Louis, and Port Wine, Sierra County, Cal.—B. Ms. PERREY says 5 A. M.

1866. September 6;

Two shocks at S. F., Cal.—S. F. D.

1866. November;

San José, Cal.—B. Ms.—*S. F. Golden Era*, November 18, 1866.

1866. December 17; night.

Antioch, Contra Costa County, Cal.—B. Ms.

1866. December 18.

Pacheco, Contra Costa County, Cal.—B. Ms.

1866. December 19; 2:20 a. m.

Subterranean noises, accompanied by shocks, in San Francisco and Sacramento, Cal.—FUCHS.—PERREY. 3 A. M.—S. F. D.

1866. December 20; 4:15 p. m.

Antioch, Contra Costa County, Cal. Also, a shock in the morning.—B. Ms.

1866. December ?

A smart shock at the Dalles, Oregon.—*Mining and Scientific Press*. Vol. 14, p. 46.

1867. January 8; daylight. [?]

Frightful earthquake at Fort Klamath, Oregon; the Klamath Lake fell six feet.—FUCHS. Two shocks, the second frightful. The air grew dark, ashes fell as thickly as snow in a storm.—B. Ms.

EARTHQUAKE AT FORT KLAMATH.—The following letter is to the *Oregon Sentinel*, from Fort Klamath, dated January 8, 1867: Editor *Sentinel*: We have singular, if not serious news, to send by the express just leaving. This morning at daylight we were startled from our sleep by the precipitate shock of an earthquake, immediately followed by a noise as of distant thunder. But in a little while quiet reigned, and every one was conversing and laughing heartily at the singular phenomenon; but our countenances soon underwent a serious change, for it began to grow dark; the whole heavens were full of a very black smoke or cloud; the air had a sulphurous smell; and ashes of a brownish color fell as fast as I ever saw it snow. We had to use candles in the mess-room. Most of us went in to breakfast, but had only got fairly into our seats, when, horror upon horror, the earth seemed rolling like waves upon the ocean; every one was thrown to the floor, only, on regaining their feet, to be placed in the same position again, accompanied with the rattling of dishes, the crashing of window glass, cracking of timber of buildings, and the screams of the frightened. You could not imagine a more perfect chaos. Some of us gained the door, and such a sight met our gaze as was probably never before beheld. The tall pines around the fort seemed lashing themselves into fury; the wagons in front of the stable were engaged in a pitched battle; horses and cattle were lying crouched upon the ground, uttering the most pitiful moans; dogs were howling, and the unearthly cries of the Klamath Indians camped near the fort, completed the scene. The sutler's store was thrown about ninety feet from its former position. There were no lives lost, nor any serious accidents to any one. There is no very serious damage done to any of the buildings, all being log and frame houses, but I do not think there is a whole pane of glass left at the post. Most of us are of opinion that a volcano has broken loose near the Klamath marsh, as a continuous dark column of smoke is seen in that direction. There was about half an hour between the first and second shocks. The first was just perceptible. The second lasted, as near as can be judged from various opinions, from two to three minutes. Further particulars will be given by the next express.

L. TENNYSON, Quartermaster's Clerk.

Mr. Whitmore has just arrived from the agency, and reports that the lake (Klamath) has lowered about six feet, and is still falling. Crooked Creek, a stream between this place and the agency, is completely dried up.—B. Ms.—*S. F. Bulletin*, January 14, 1867.

1867. February 1; ?

Three shocks in San Diego, Cal.—FUCHS.—PERREY.

1867. April 12; 4:50 p. m.

Two shocks in San Francisco.—FUCHS.—PERREY says 5:50 p. m.

1867. September 22; 5:35 p. m.

San Francisco, Cal.—FUCHS.

1867. November 30;

Quincy, Plumas County, Cal. Severe shock.—B. Ms.

1867. December 1; 11:12 p. m.

Forest City, Cal.—FUCHS.—PERREY also. Nevada City, very heavy.—B. Ms.

1868. January 2; 9 p. m.

Lake County.—B. Ms.—*Yolo County Hist.*, pp. 56-7.

1868. March 24; 11:22 a. m.

Sharp shock, San Francisco, Cal.—*Mining and Scientific Press*. At 11:22 a. m., lasted six to ten seconds.—B. Ms.

1868. March 25;

Alameda County, Cal.—B. Ms. *S. F. Bulletin*, March 26.

1868. March 28; about 11 p. m.

S. F., Cal.—S. F. D.

1868. March 29; about 9 p. m.

S. F., Cal.—S. F. D.

1868. About April 23;

Healdsburg, Cal.—*S. F. Bulletin*, May 7, 1868.

1868. April 29; 7:15 a. m.

Three distinct shocks, no damage done, Yreka, Cal.—B. Ms. The first experienced here; it was accompanied by a rumbling noise.—*S. F. Call*, April 30, 1868.

1868. May 7; 12 a. m.

Severe shock at Healdsburg, Cal.—*S. F. Bulletin*, May 7, 1868.

1868. May 9; 11:30 p. m.

Calistoga, Napa County.—B. Ms.—*Alta*, May 11, 1868.

1868. May 18;

Three hundred miles west of San Francisco, in lat. 44° 7' N., and long. 139° 7', a submarine earthquake.—PERREY.—*Mém. Cour.* 22, p. 80.

1868. May 24; 9 p. m.

Two shocks in Sacramento, Cal.—FUCHS. Not felt in S. F.; violent in the State of Nevada.—PERREY.

1868. May 26; 10:37 p. m.

San Francisco, Cal.—FUCHS.—PERREY. Two shocks.—B. Ms.

1868. May 27; about 2 a. m.

S. F., Cal., light shock.—B. Ms.

1868. May 29; 9 p. m.

Three shocks, Lassen County, Cal.: first at 9 p. m.; two others in the course of fifteen minutes.—B. Ms.—*S. F. Bulletin*, June 12, 1868. About 9 p. m., series of shocks in interior of California and in Nevada: but not at S. F., nor north of a line from Sacramento to Ft. Churchill; felt in Sacramento.—B. Ms.

1868. May 30;

Severe earthquake at Mukelto and the Tulalip Reservation, W. T.—*Bulletin*, June 2, 1868.

1868. May;

A severe earthquake (not felt in Northern or Central California) opened a long fissure in the earth at Dos Palmas, S. P. R. R.—H. Ms.—Editorial *S. F. Bulletin*, March 29, 1872.

1868. June ?

San Diego? Earthquake wave on Pacific Coast.—B. Ms.—*S. F. Bulletin*, June 13, 1868.

1868. June 2; 9:30 a. m.

Very severe, Downieville and Forest City.—*S. F. Bulletin*, June 10, 1868.

1868. July 24;

Slight shock at S. F., Cal.—*Appleton's Annual Cyclopædia*, 1868.

1868. July 24; 6:30 p. m.

Severe shock in Tulare County, Cal.—*S. F. Bulletin*, July 23, 1868.

1868. August 2;

Los Angeles (several shocks).—B. Ms.

1868. August 9; about 10 p. m.

S. F., Cal.—S. F. D.

1868. August 13;

The earthquake at Arica, Peru, on this date, produced tidal waves felt all through the Pacific, and registered at S. F. and San Diego. Velocity of the sea-wave 369 (or 348) miles per hour.—J. E. HILGARD in *Amer. Jour. Sci.*, vi. p. 77. Tidal wave sixty feet high in Southern California; San Pedro Bay.—R. A. PROCTOR, in *Nature*.

1868. August 24;Santa Cruz, Cal.—*S. F. Bulletin*, September 3, 1868.**1868. August 24; 11:30 a. m.**

S. F., Cal.—S. F. D.

1868. August 28; about 1 a. m.

S. F., Cal.—S. F. D.

1868. August 31;

Severe shock at Santa Cruz, Cal., lasting ten or fifteen seconds.—B. Ms.

1868. August–September 28;

It is the opinion of FUCHS (p. 10) that a period of earthquakes in the Sierra Nevadas began early in August, 1868. On September 4, 5, 6, there was a great earthquake with more than five hundred shocks, and the period lasted till September 28.

1868. September 3–28;

"Kern River, Inyo County, Cal., September 3, during the night frequent rumbling noises and tremulous motion of the earth. September 4, 8 A. M., severe shock; from 8 to 9 A. M., forty-one distinct shocks. During the remainder of the day the shocks continued at intervals of 5 to 10 minutes. Light shocks continued until the morning of the 6th of September, when the party moved their camp. Up to this time there had been about five hundred shocks. September 6–11, one or two shocks every hour. September 17, 18, 19, about one shock every hour. September 20, 21, 22, much more frequent and severe; then the frequency and violence abated, but continued at intervals of an hour or so, up to the time they left on the 28th of September."—J. E. CLAYTON, M.E., in *Proceedings of the California Academy of Sciences*, vol. IV, part 1. See also PERREY.—*Mém. Cour.* 23, p. 64.

1868. September 13, 14, 15;

A correspondent of the *Sacramento Union*, writing from Owens Lake, gives an interesting account of a succession of earthquakes that took place in that region, among the mountains, on the 13, 14, 15, of September. The shocks were severe enough to rattle down rocks from the mountains into the valleys, and to excite great alarm among the few inhabitants. About the same time, there was an earthquake in Alpine County, which was quite severe, showing that the commotion must have extended over hundreds of miles.—*Proceedings of the California Academy of Sciences*.

1868. September 3, etc.;

Not felt at Independence, Inyo County.—B. Ms.

1868. September 4–17;

Inyo County, Cal., September 4, two shocks; forty shocks in one hour at Lone Pine; September 12, one shock; September 14, two shocks; September 17, one shock; September 11–12, three hundred shocks; sky was very full of smoke.—B. Ms.

1868. September 17;

Two shocks at Nevada City, Cal.—B. Ms.

1868. September 19; 9 a. m.

Two heavy shocks at Alpine, Cal. The air became dark, and mountains one half mile distant could not be seen. At 5 P. M. other shocks.—B. Ms.

1868. September 26; 12:40 a. m.

Ukiah, Mendocino County, Cal., severe shock; tumbling furniture about.—B. Ms.

1868. October;

Near head of Kern River. [S. F. *Bulletin*, October 17, 1868, says: "There is quite a phenomenon on the Sierra Nevadas, at the head of Kern River. The earth has been shaking for more than two weeks—almost a constant shake. It shakes the rocks down from the mountain, and makes the earth wave like the sea." * * *]

1868. October 3; 12:40 a. m.

Very severe shock in Ukiah Valley, Cal.—B. Ms.—*Alta*, October 7, 1868.

1868. October 6;

Silver Mountain, Cal.—*Appleton's Annual Cyclopædia*, 1868.—PERRY.

1868. October 21;

The great earthquake at San Francisco, Cal. The first shock was at 7h. 53 $\frac{1}{2}$ m. A. M. Its direction was northerly and southerly. Its duration was forty-two seconds. The second shock came at 9:23 A. M., lasting five seconds. Lighter and briefer tremors occurred at intervals of about half an hour, till 12:15 P. M. The first shock was most severely felt on the eastern side of the city, on the made land, between Montgomery Street and the bay. On the solid land no serious damage was done to any well constructed house. Window panes were broken, chimneys twisted or thrown down, mantel ornaments overturned, etc. Steeples swayed to and fro. On Russian and Telegraph Hills the shock was comparatively light. On the flat, between Howard Street and the Mission, the shock was most severe. The Custom House was badly damaged. It was poorly constructed. Coffee & Risdon's building (corner of Market and Battery Streets) was of brick, three stories high, and unfinished. The walls of a portion of this fell, killing a man. The machines in the Union Foundry (First and Mission Streets) were put out of order. Several buildings in this neighborhood were more or less wrecked. The tall chimney of the San Francisco Gas Works (Howard and Fremont Streets) was thrown down. The Mission Woolen Mills were damaged badly. As in 1865, a small crevasse was opened on Howard Street, beyond Sixth. The Deaf, Dumb, and Blind Institution was damaged. The greatest damage was done in a belt several hundred feet wide, running northwest and southeast, commencing at the Custom House and ending at the Folsom Street wharf. The tall chimney of the United States Mint was damaged. The ferry steamer *Contra Costa* was near Angel Island, and felt the shock strongly. Shocks were noted at 7:53; 8:10; 8:15; 8:30; 8:45; 9:20; 9:35; 10; 10:30; 11:05 A. M., and at 12:15 and 2:58 P. M. Cliff House, S. F.; an unusual commotion in the sea; and the waves came fifteen or twenty feet further inland than usual. There were about thirty casualties in the 150,000 inhabitants. Five deaths occurred from falling walls, etc. Not a single well built house on the solid land suffered materially, whether of brick, stone, or wood. Wooden houses suffered least.—H. Ms. Derived from S. F. daily papers of the few days immediately following the shock. See ROWLANDSON, p. 61, *et seq.* No register of this shock on the tide-gauges at San Diego and Fort Point.

Oakland. The draw of the railroad bridge was thrown twelve inches out of line. The water of the bay was smooth and no wave was noticed due to the shock. Buildings and chimneys fell to the south.

Martinez. The earthquake was heavy at 7:57 A. M. The Court House was wrecked.

Alameda. Several buildings badly damaged.

San Leandro. Several buildings badly damaged; one man killed.

Alvarado. Buildings damaged.

San Lorenzo. Several chimneys thrown down.

Haywards. Very severe; twenty-two shocks during the morning. Not a building that was not damaged, and several wrecked.

Amador Valley. The shock was light.

Mare Island Navy Yard. Chimneys thrown down. The shock threw down a person who was walking.

Vallejo. Chimneys thrown down.

Redwood City. The brick Court House wrecked.

Marysville. Light shock.

Grass Valley. Severe, causing lamps, etc., to vibrate.
 Sonora. Slight shock.
 San Mateo. Severe, with damage to property.
 Placerville. Light shock.
 Folsom, Sacramento County. Sharp shock.
 At sea. The *Factotus* was at anchor, in deep water, fifteen miles west of the Heads. The shock was severely felt.
 San José. Buildings damaged, chimneys thrown down.
 Santa Clara. Buildings damaged, chimneys thrown down.
 Gilroy. Chimneys thrown down.
 Santa Cruz. Brick buildings cracked.
 Healdsburg. Severe; clocks were stopped.
 Woodland (Yolo County). Severe.
 Centerville. Buildings destroyed and others badly damaged.
 Mission San José. Buildings destroyed and others badly damaged.
 San Juan. Severe shock.
 Sacramento. Severe shock, no damage.
 San Rafael. Severe shock, chimneys thrown down.
 Petaluma. Buildings damaged, chimneys thrown down.
 Santa Rosa. Buildings damaged, chimneys thrown down.
 Somerville, Antioch, Clayton. Buildings damaged, chimneys thrown down.
 Los Angeles. No shock felt.—H. Ms.

1868. October 21; 7:50 a. m.

At 7h. 50m. A. M., after dull rumblings, heavy shocks, lasting 140 seconds, began; six or seven shocks before 11 A. M.; and at 3 P. M. another, and the last about midnight. Earthquakes were felt over all California; the heaviest were the following: Sacramento, 7:59; Oakland, 10:30, 11:45; Marysville, 7:55, and 8, and 1:25 A. M.—FUCHS.

1868, October 21, San Francisco. The shock was longer and more severe than that of October 8, 1865. Several persons were killed by falling cornices. The shock was felt in the interior in every direction, and with severity. The surface of the earth visibly undulated. Brick buildings were tumbled down or badly cracked in several places, including Oakland and San Leandro, and several lives were lost. Not a single thoroughly good building, even in the lower part of the city, was seriously injured.—*S. F. Bulletin*, October 21, 1868.

1868, October 21, San José. The oscillation was from southeast to northwest, and lasted one half minute. Considerable damage was done to property. No lives were lost. Damage to Presbyterian Church amounted to \$2,000.—*San José Advertiser*, October 4, 1868.

1868, October 21. Account of the earthquakes in San Francisco October 8, 1865, and October 21, 1868.—*San José Pioneer*, February 9, 1878. This earthquake was not felt in San Diego.—B. Ms.

1868, October 21, San Leandro. One man was killed attempting to escape through the falling walls of the Court House, which, with the jail, was laid in ruins. Several concrete buildings were entirely destroyed, and a great many frame buildings partially so. After the earthquake was over, only two chimneys remained standing. The loss was not much short of \$100,000. Neighboring towns were severely shocked. Haywards was laid in ruins. But little injury was done at Oakland. It was the most severe shock experienced on the coast by white men up to that time.—*San Leandro Gazette*, October 24, 1868.

1868, October 21. Petaluma. Considerable property destroyed. Vibrations from east to west. Three distinct shocks following each other in rapid succession, lasting from ten to fifteen seconds. Light shocks for four hours afterwards.—*Petaluma Journal and Argus*, October 22, 1868.

1868, October 21. Sacramento. Severe earthquake. The water of the river receded, and in a short time returned in a wave at least two feet in height.—*Sacramento Bee*, October 21, 1868.

1868, October 21. Santa Cruz Mountains, near Pescadero. Great damage done to the redwood trees. Limbs fell to the ground, and large pieces of rock rolled down the mountains. It is said that the waters of Pescadero Creek became muddy in a moment, and that the surface was covered with bubbles, which burst with a slight report and a small flame when a match was applied to them.—*Grass Valley Union*, October 29, 1868. [??]

1868, October 21. See brief report on the cause and effect, by the committee of merchants in San Francisco Chamber of Commerce report, 1870. See also *Alta*, December 1, 1868.

1868, October 21; about 8 A. M., in San Francisco. Killed five persons by throwing loose bricks from the tops of buildings upon them, and no person was severely injured in a house. The better class of structures was not damaged. A dozen brick buildings with weak foundations on made ground were cracked so as to be untenable. HITTELL; *History of San Francisco*, pp. 370-7.

1868, October 21. Brick and concrete buildings in Pacheco were destroyed. The shocks were severely felt throughout Contra Costa County, except at Antioch. There no chimneys were thrown down, nor were any walls cracked.—*Pacheco, Contra Costa County, Gazette*, October 24, 1868.

1868, October 21. Three heavy and distinct shocks were felt in Nevada City. The most severe known up to this time.—*Nevada City Daily Transcript*, October 22.

1868, October 21. Theshock was severe, or very severe, at Martinez, Alameda, Alvarado, San Lorenzo, Haywards, Mare Island, Vallejo, Redwood, Grass Valley ("quite a severe shock"). San Mateo, San José, Gilroy, Santa Cruz, Healdsburg, Woodland (Yolo County), Centerville, Stockton, San Rafael, Petaluma, Santa Rosa, Contra Costa County.—H. Ms. Yolo County.—B. Ms.

1868, October 21. The shock was light at Marysville, Sonora, and Amador Valley.—H. Ms. No shock was felt at Los Angeles, San Diego, etc.—H. Ms. For a complete account of this shock in Alameda County, see HALLEY, Centennial Book of Alameda County, pp. 257-269. Articles on this earthquake may be found in the following places (from the Bancroft Ms.): *S. F. Times*, October 22, 23, 24, 26, 1868. Telegrams from all parts of the State, in *S. F. Call*, October 22. *S. F. Abend Post*, October 22. Further particulars, loss of life and property, shock in the interior, and estimated damages to buildings and stock.—*S. F. Bulletin*, October 22 and 23. *Alta California*, October 22, 23, and editorial on earthquakes in *Alta*, October 24. LYON'S *Lights and Shades*, pp. 318 and 324. Earthquake throughout the State; twelve persons killed.—*Sacramento Union*, October 22. *S. F. Bulletin*, October 21, 22, 23, 24, 26, 27, 29. *S. F. Spirit of the Times*, October 24. San Leandro and Haywards. Long article in *Alta* of October 27. *S. F. Call*, October 23. Facts about earthquakes; earthquake in the interior.—*Alta*, October 24, 1868. Open crack in Haywards.—*S. F. Call*, October 25. Report of Earthquake Commission.—*Alta*, December 1, 1868. *S. F. Chronicle*, October 21, 22, 23, 24. Petaluma.—(Oregon) *Deutscher Zeitung*, October 24, 1868. *S. F. Monitor*, October 24. *Cal. Christian Advocate*, October 29. *S. F. Golden Era*, October 24. *S. F. Golden Era*, October 31 (two articles). Grass Valley. Vibrations from southwest to northeast.—*Grass Valley Union*, October 22. *San Leandro Democrat*, October 24, 1868. *Vallejo Weekly Chronicle*, October 31. Professor HANKS says that a circle with Haywards as a center and 173 miles as radius will cover every point where the vibration was felt. The area of such a circle is 94,000 square miles, or about three fifths of the area of California.—H. Ms.

Fruitvale, Alameda County. Professor BUNNELL was walking in a field at the time of the first shock. He heard a loud report, which he referred to the direction of S. F., and immediately felt the earth tremble so violently as to make it difficult to stand upright.

Dr. GIBBONS kindly communicates the following record of forty-nine shocks during October and November: October 21; two heavy shocks, twelve light ones (14) during the day, four during the night. October 22; eight day and night. October 23; four till 9 P. M. October 24; three from 6 A. M. to 9 P. M. October 25; three. October 26; two, very heavy. October 27; one. October 28; two. October 29; one. November 3; one, at 7 A. M. November 10; one. November 11; one. November 15; one. November 16; three, or forty-nine in all.

1868. October 22;

Tremors in S. F., Cal.—FUCHS.—PERREY.

1868. October 23; 2:20 a. m.

Smart shock, San Francisco, Cal.—T. T. Another shock 7:30 A. M.—*Appleton's Annual Cyclopaedia*, 1868. 2:15 A. M.; then two light shocks; and another at 7:30 P. M.—PERREY.

1868. October 25;

Tremors in S. F., Cal.—FUCHS. Slight shock at 8 A. M.—S. F. D. A strong shock, very long, at 8:05 A. M.—PERREY.

- 1868. October 26; about 11 a. m.**
Two shocks, San Francisco, Cal.—S. F. D.
- 1868. October 26; 11:54 p. m.**
Smart shock, San Francisco, Cal.—T. T. Also in Oakland.—FUCHS.—
PERREY.
- 1868. October 27;**
Heavy shock in Oakland, Cal.—FUCHS. S. F.—PERREY.
- 1868. October 30; 10:20 p. m.**
Slight shock, San Francisco, Cal.—T. T.
- 1868. October 31;**
S. F., Cal.—B. Ms.
- 1868. November 1; 6:32 p. m.**
Slight shock, San Francisco, Cal.—T. T. Petaluma, Cal.—B. Ms.
- 1868. November 4; 8:58 p. m.**
Smart shock, San Francisco, Cal.—T. T. Two "pretty severe" shocks at
Monterey.—B. Ms.
- 1868. November 5;**
Heavy shocks in S. F., Cal.—FUCHS. One this day also at Victoria, Van-
couver.—PERREY.
- 1868. November 17; 1:30 p. m.**
Quick and violent shock at Santa Cruz.—*Santa Cruz Times*, November 20,
1868. Quoted in *S. F. Bulletin*, December 1.—B. Ms. *S. F. Call*, December
1, 1868.
- 1868. November 20;**
San Francisco.—PERREY.
- 1868. November 30;**
Several shocks in Oakland, Cal.—B. Ms. *S. F. Bulletin*, December 1.
- 1868. December 26;**
Two shocks at Nevada City, Cal.—B. Ms.
- 1868. December 31; 11:56 a. m.**
Two slight shocks at S. F., Cal.—B. Ms.—*S. F. Times*, January 1, 1869.
- 1869. January 7;**
Two sharp shocks near the Newton Copper Mine, Amador? County, Cal.—
B. Ms.—(Jackson) *Amador County Ledger*, January 9, 1869.
- 1869. January 22; about 4 a. m.**
At Haywards, Alameda County.—B. Ms.—*S. F. Herald*, January 23, 1869.
- 1869. January 28;**
Slight shock in S. F., Cal.—FUCHS.—PERREY. 4 A. M., shock in S. F., and
Santa Cruz Mts.—B. Ms.—*S. F. Times*, January 30, 1869.
- 1869. January 29; 12 m.**
Slight shock in S. F., Cal.—FUCHS.—PERREY.
- 1869. January 29; 1:45 p. m.**
Heavy shock at Watsonville, Santa Cruz County.—B. Ms.—*S. F. Times*,
January 30, 1869.
- 1869. February 1; 10 p. m.**
Slight shock at Livermore, Alameda County, Cal.—B. Ms.—*S. F. Herald*,
February 3, 1869.

54 *LIST OF RECORDED EARTHQUAKES.*

1869. February 10;

San José, Cal.—FUCHS.—PERREY. Santa Clara.—B. Ms. Submarine earthquake recorded by the tide-gauge at Fort Point, S. F.—*Mining and Scientific Press*.

1869. February 13; 4:30 a. m.

Light shock in S. F., Cal.—FUCHS.—PERREY. 4 A. M.—S. F. D.

1869. March 11; 9:45 p. m.

San José, Santa Clara County, Cal.—B. Ms.—*S. F. Times*, March 16, 1869.

1869. April 1; 5:47 p. m.

Smart shock, San Francisco, Cal.—T. T. Also in San José, Petaluma, and Stockton.—FUCHS.—PERREY. Lasted eighteen seconds in S. F.; occurred at 5:55 P. M. at Stockton, at Napa City, and Sonoma.—B. Ms.

1869. April ?;

Tuolumne County, Cal.—B. Ms.—*S. F. Times*, April 17, 1869. [The above is the reference in B. Ms., but an examination of this paper failed to find the item.]

1869. May 19; 11:20 a. m.

A slight shock at S. F., Cal.—B. Ms.—*S. F. Times*, May 20, 1869.

1869. May 30; 10:37 a. m.

S. F., Cal.—B. Ms.—*S. F. Times*, May 31, 1869.

1869. June 1;

Earthquake sea waves recorded at Ft. Point, (S. F.)—*Mining and Scientific Press*.

1869. June 2;

Santa Cruz and Gilroy papers speak of recent earthquakes, and the Fort Point tide-gauge recorded an earthquake wave.—*Mining and Scientific Press*.

1869. June 12; 9:15 p. m.

Sharp shock at Eureka, Humboldt County, Cal.—B. Ms.—*S. F. Times*, June 29, 1869.

1869. June 25; 6:20 a. m.

S. F. and San José, Cal.—B. Ms.—*S. F. Times*, June 26, 1869.

1869. July 23; 2:28 p. m.

Sharp shock at San Juan, Monterey County.—B. Ms.—*S. F. Times*, August 3, 1869.

1869. July 24;

Shock at San Juan, Monterey County.—B. Ms.—*S. F. Times*, August 3, 1869.

1869. September 5;

Arizona, California [*sic*].—PERREY, *Mém. Cour.* 22, p. 80.

1869. September 12;

?, California.—FUCHS.—PERREY.

1869. September 13;

—California.—FUCHS. Nevada City, Cal.—B. Ms. On the coast, a light shock; heavy at San Luis Obispo, light at Sacramento.—PERREY.

1869. September 14;

Heavy shock in San Luis Obispo, Cal.—FUCHS.—[See September 13, PERREY's note. E. S. H.]

1869. September 15;

Light shock in Sacramento, Cal.—FUCHS.

- 1869. October 6; midnight.**
At sea, fifty miles from Mendocino, Cal.—B. Ms.—*S. F. Times*, October 7, 1869.
- 1869. October 7; at night.**
Severe shock at San Bernardino, Cal.—B. Ms.—*S. F. Times*, October 16, 1869; also October 19, 1869.
- 1869. October 8; 1:30 a. m.**
Severest shock ever felt at Ukiah Valley, Mendocino County, Cal.—B. Ms.—*S. F. Times*, October 14, 1869.
- 1869. October 21;**
New River Station (near San Diego?).—B. Ms.
- 1869. October;**
Los Angeles.—B. Ms.
- 1869. December 14; morning.**
Santa Cruz, Cal.—B. Ms.—*S. F. Golden Era*, December 19, 1869.
- 1869. December 15;**
Heavy shock in San Luis Obispo, Cal.—FUCHS.—PERREY.
- 1869. December 19; p. m.**
Several shocks in Mariposa, Cal., and in the mines at Virginia City, Nevada. Also a. m. December 20.—FUCHS. In the a. m. several shocks at Mariposa.—PERREY.
- 1869. December 20; 8 p. m.**
Strong shock in Grass Valley, Cal.; slightly felt at Sacramento.—FUCHS.—PERREY. At Ophir Hill also.—B. Ms.
- 1869. December 26; 5½ p. m.**
Three shocks in Marysville; others in Stockton, etc. In Sacramento, two shocks in the daytime; at 9 p. m., another shock here, and at Grass Valley, etc. Twenty-six shocks at Mariposa during this night.—FUCHS. Nevada City and Grass Valley.—B. Ms.
Mokelumne Hill, Calaveras County, Cal. A house near Railroad Flat was lifted bodily several times.—B. Ms. Lowe Hill; Stockton 5:52 p. m.; Truckee; Grass Valley; Nevada; Chico; Mariposa.—PERREY. Nevada City.—B. Ms.
- 1869. December 27;**
This day was the maximum for the California earthquakes of this month; 2 a. m., very heavy shocks in Marysville; 2:10 a. m., houses thrown down in Sacramento, etc.—FUCHS.
- 1869. December 27; 2 a. m.**
Marysville, Sacramento, 2 a. m.—PERREY.
- 1870. January ?; "end of January."**
San Francisco, Cal.—FUCHS.
- 1870. January 3;**
San Bernardino, Los Angeles.—B. Ms.—*S. F. Abend-Post*, January 6, 1870.
- 1870. January 3; 11 p. m.**
"Quite a shock," Bakersfield, Kern County, Cal.—*S. F. Bulletin*, January 6, 1870.—FUCHS.
- 1870. February 4;**
Light shock in S. F., Cal.—FUCHS.
- 1870. February 13-14; night.**
Two light shocks in S. F., Cal.—FUCHS. Oakland, Petaluma.—B. Ms.

THE HISTORY OF THE STATE OF CALIFORNIA

1870. February 7 12.10 P.M. 1 M.

1870. February 7 12.10 P.M. 1 M. (Continued from page 100)

1870. March 4

1870. March 4 (Continued from page 100)

1870. March 11

1870. March 11 (Continued from page 100)

1870. April 2 12.10 P.M. 1 M.

1870. April 2 12.10 P.M. 1 M. (Continued from page 100)

1870. April 2 12.10 P.M. 1 M.

1870. April 2 12.10 P.M. 1 M. (Continued from page 100)

1870. April 11

1870. April 11 (Continued from page 100)

1870. April 12 12.10 P.M. 1 M.

1870. April 12 12.10 P.M. 1 M. (Continued from page 100)

1870. April 15 12.10 P.M. 1 M.

1870. April 15 12.10 P.M. 1 M. (Continued from page 100)

1870. April 18 12.10 P.M. 1 M.

1870. April 18 12.10 P.M. 1 M. (Continued from page 100)

1870. April 25

1870. April 25 (Continued from page 100)

1870. May 4

1870. May 4 (Continued from page 100)

1870. May 11

1870. May 11 (Continued from page 100)

1870. May 18

1870. May 18 (Continued from page 100)

1870. August 4 12.10 P.M. 1 M.

1870. August 4 12.10 P.M. 1 M. (Continued from page 100)

1870. August 11 12.10 P.M. 1 M.

1870. August 11 12.10 P.M. 1 M. (Continued from page 100)

1870. September 1 12.10 P.M. 1 M.

1870. September 1 12.10 P.M. 1 M. (Continued from page 100)

1870. September 8 12.10 P.M. 1 M.

1870. September 8 12.10 P.M. 1 M. (Continued from page 100)

1870.

1870. (Continued from page 100)

1870. (Continued from page 100)

1870. (Continued from page 100)

1870. February 4 7.17 A.M.

1870. February 4 7.17 A.M. (Continued from page 100)

- 1871; February 9;**
San Francisco, Cal.—S. F. D.
- 1871. March 2; 1:05½ p. m.**
Severest for several years in Eureka, Humboldt County, Cal.; duration, twenty seconds; another shock twenty-five minutes later; another, 7:30 P. M. This shock was even more severe to the south and east, at Rhonerville, Hydesville, in the same county.—B. Ms.—*S. F. Call*, March 15, 1871. Chimneys thrown down at Rhonerville and Petrolia. The oscillations lasted twenty minutes.—*APPLETON'S Annual Cyclopaedia*, 1871.
- 1871. March 2;**
Light keeper's house at Mendocino, Cal., injured.—B. Ms.—*S. F. Call*, March 28, 1871.
- 1871. March 6;**
Weak shock in Carthago, Inyo County, Cal.—FUCHS.
- 1871. April 2; 7:49 p. m.**
Shock at San Francisco, Cal.—T. T. Two light shocks.—FUCHS. Also in Contra Costa County.—B. Ms.
- 1871. April 23;**
Three slight shocks at S. F., Cal.—S. F. D.
- 1871. May 19;**
Shocks in Washington Territory, and on Mt. Raynier. During the whole month shocks on the coast.—FUCHS.
- 1871. June 6; about 9 p. m.**
Two strong shocks at Bear Valley, California.—FUCHS.
- 1871. June 21;**
Strong earthquakes, Cal.—FUCHS.
- 1871. July 5; 6:54 a. m.**
Visalia, Cal.—FUCHS. Also severe shock at Independence and Swansea, Inyo County.—B. Ms.
- 1871. July 11; 7 p. m., a. m. ?**
Independence, Inyo County, Cal.—B. Ms.
- 1871. July 11; 7:30 p. m.**
A shock more severe than that of July 5th, at Swansea, Inyo County, Cal.—B. Ms. Another shock at 12, midnight.—B. Ms.
- 1871. July 11; 9 p. m.**
Bishop's Creek, Inyo County, Cal.—B. Ms. Severe at Owensville.—B. Ms.
- 1871. July 12; midnight.**
Swansea, Inyo County.—B. Ms.
- 1871. July 12; 12 m.**
Bishop's Creek, Inyo County, Cal.—B. Ms. Severe at Owensville.—B. Ms.
- 1871. July;**
Kern County.—*Mining and Scientific Press*, July 22, 1871.
- 1871. August 25;**
Santa Rosa.—B. Ms.
- 1871. August 31;**
Gilroy.—B. Ms.
- 1871. Early in September;**
Castroville, Monterey County.—B. Ms.

58 *LIST OF RECORDED EARTHQUAKES.*

1871. September 15; 6:45 a. m.

Gilroy, Cal.—FUCHS.

1871. September 18;

S. F., Cal.—S. F. D.

1871. October 21;

Calistoga.—B. Ms.

1871. October 27;

Temecula, near San Diego, Cal.—B. Ms.

1871. December 12; 2:30 a. m.

Quite severe shock at Humboldt.—B. Ms.—S. F. Call, December 24, 1871.

1871. No date;

Twenty shocks during the year, no dates given, at Moleje, Southern California.—FUCHS.

1872. February 6;

Santa Barbara, "the first shock for fifteen years."—B. Ms. [There are shocks recorded, 1857, March 14; 1858, September 2, and 1860, April 16, within the period of fifteen years; but none from 1860 to 1872—twelve years.—E. S. H.]

1872. February 11;

Stockton.—B. Ms.

1872. February;

Fresno County.—B. Ms.

1872. March 17; about 1 o'clock.

Severe shock at Lone Pine, Cal.—C. G. R. "Frightful."—FUCHS.

1872. March 18;

S. F., Cal.—S. F. D.

1872. March 23;

San Diego.—B. Ms.

1872. March 25.

Severe shock at Jackson, Amador County, Cal.—B. Ms.

1872. March 26;

Great Inyo County earthquake. Shocks were felt on this day in the City of Mexico, New Madrid, Mo., and many other distant points.—B. Ms. FUCHS does not mention any earthquakes on this day except one on the coast of Chili. On March 27, one at Oajaca, Mexico. He does not mention an eruption of Colima. The earthquakes of March and April, 1872, were, according to WHITNEY (*Overland Monthly*, vol. 9, p. 271), as follows:

March 6; central and eastern Germany.

March 11; destructive shocks in Japan.

March 23; Unionville and Winnemucca, Nevada.

March 26; the great earthquake at Inyo, which extended over all of California except its northern end, and throughout nearly all of Nevada.

March 26; City of Mexico—8-9 A. M.

March 26; Paducah, Ky.

March 28; Salt Lake City.

April 3; terrible shock at Antioch.

April 14; Accra; gold coast of Africa.

April 15; volcano of Merapi, Java, in eruption.

April 16, 17, 18; severe shocks in Iceland.

April 24; great eruption of Vesuvius.

April —; great eruption in the Philippine Islands.

March 26. The shock was felt as far as Winnemucca, Nevada—462 miles east of San Francisco.—B. Ms. Long, rolling, but moderate shocks in S. F.—T. T. The persistent duration of the shock was remarkable and unique at S. F.

- March 26. At Big Pine, Inyo County, there was a fissure opened from 50 to 200 feet wide, in places 20 feet deep, extending for miles, close to the eastern base of the Sierras. Near Fish Springs the earth was heaped up in ridges 5 to 10 feet high and 20 to 30 feet across. From Independence to Bishop's Creek (50 miles), the ground is cracked all over the surface. At Bishop's Creek the shock was severe, but light compared with that to the south. It commenced at 2:30 A. M., and from then to 6:30 A. M. there were not less than 50 shocks.—B. Ms.—*S. F. Bulletin*, March 28, April 1, 1872.
- March 26. Lone Pine, Inyo County, Cal. In Lone Pine every adobe and stone building was leveled to the ground. Sixty persons were killed and wounded in that place alone.—B. Ms. At Independence, the damage to property was great. In other places in that county the loss of life and property was considerable. In Lone Pine the damage to property was \$132,000; at Independence, \$43,000; at Camp Independence, \$26,000; in the county, \$237,000.—B. Ms.—*Inyo Independent*, March 30, 1872.
- In the same paper of April 13, the editor says the losses were overestimated. The total loss was less than \$100,000. (The people at Lone Pine stopped the paper for underestimating the loss.)—*Inyo Independent*, April 20, 1872. During this earthquake not a single wooden building in Inyo County was injured to a dangerous extent, and not a single person in such a building was injured at all. One thousand shocks in two days.—Fuchs.
- March 26. The Inyo earthquake was felt from the City of Mexico to Oregon. Shocks were felt on the same day at Paducah, Ky. At Camp Cady, A. T., its force was sufficient to move heavy wagons several feet. The volcano of Colima, in Mexico, burst into eruption on this day.—B. Ms.—*Inyo Independent*, April 20, 1872. [Note.—No eruption of Colima is mentioned by Fuchs.]
- March 26. Millerton, Fresno County, 2:15 A. M. Shocks continued until 11 o'clock of the same day. No damage was done. At Bennett's Station, Merced County, a stone house was thrown down. At Chowchilla, quite severe. At Fort Miller, quite severe.—B. Ms.—*Fresno Expositor*, April 30, 1872.
- March 26. Fifty-two out of fifty-nine buildings were thrown down in Lone Pine, Inyo County. At Los Angeles artesian wells were seriously affected by earthquake. Some of them stopped entirely. At Glennville, Kern County, large and important springs opened. The larger Owens Lake was from 3 to 5 feet higher after the earthquake than before. The little lake 3 miles from Lone Pine entirely disappeared. Owens River, at Independence, dried up and remained so for six hours. On Tuesday, the first day of the shocks, a dense fog or smoke prevailed over the valley. After the shocks, smoke and fire were seen issuing from the earth, the flames being blue. A river was open and running between Lone Pine and Inyo Lake, 75 yards wide and 2 feet deep.—B. Ms.—*Healdsburg Russian River Flag*, April 25, 1872.
- March 26. Inyo County. The night before was calm, clear, and frosty, with the moon just past the full. At Big Pine the shock was very severe. At Bishop Creek somewhat less so. At Sierra, brick buildings were cracked. At Benton, the same. At Swansea, buildings were leveled. At Belmont, a few stone cabins were thrown down.—B. Ms.—*Inyo Independent*, March 30, 1872.
- March 26. Yosemite Valley, many rocks fell, filling the valley with dust and smoke. The largest trees waved to and fro, and were bent about like mere twigs.—B. Ms.—*S. F. Bulletin*, April 10, 1872.
- The water of Owens Lake, Inyo County, rose very rapidly in July, 1872, sometimes as much as 4 or 5 inches in a night. During this period the water in Owens River, the main and almost only source of supply, was constantly diminishing. For a short time after the earthquake the waters of the lake fell several feet, and became stationary, remaining at about the same point until the time mentioned. Previous to the earthquake, the lake had been steadily rising for 10 years. Innumerable springs broke out all along the foothills.—B. Ms.—*Inyo Independent*, August 3, 1872. At Lone Pine, Big Pine, Independence, — the shock was severest; at Bishop's Creek, Aurora, Benton, and at the south end of Owens Lake the shock was less severe.
- March 26 to April 10. Inyo, Cal. The shocks continued up to April 10 at intervals of a few hours, and in the mountains near by explosions were frequent, resembling distant artillery.—B. Ms.—*Alta*, April 11, 1872, April 12, 1872.
- March 26. Cerro Gordo and Eclipse Mines, Inyo County, Cal. The rocking motion was distinctly observed, especially in the timbering, and the miners went to the surface, but soon resumed work.—B. Ms.—*Inyo Independent*, April 20, 1872.

- March 26, San Francisco, 2:30 A. M. The shock was comparatively light in San Francisco, but was the most severe on record at other places. It extended at least from Red Bluff, in the north, to Visalia, in the southern part of the State, and is said to have reached up into the Sierras to an elevation of 3,000 or 4,000 feet. The whole of the Sacramento, San Joaquin, and Tulare Valleys were disturbed, the area of disturbance being 500 miles long by 60 to 100 miles wide. The shock was severest in the valleys. It appears to have been of greatest energy near Visalia, in the Tulare Valley, which is the bed of a former lake. The alluvium was profoundly and frequently agitated, and shocks were long continued.—B. Ms.—*S. F. Bulletin*, March 26, 1872.
- March 26. Marysville. Motion from south to north. Bangor, shock from the east.—B. Ms.—*Marysville Appeal*, March 27, 1872.
- March 26. At the Kearsarge Mill in Inyo County, located at an altitude of nearly 8,000 feet above the sea, electric shocks from a stove were felt.—B. Ms.—*Inyo Independent*, April 20, 1872.
- March 26. Mariposa County. Several shocks all through this section of the country, continuing for several days.—B. Ms.—*Mariposa Gazette*, March 29, 1872.
- March 26. Los Angeles. Vibrations were from east to west. In Anaheim they were from north to south. In Visalia the most damage was done. Brick buildings were strained and cracked. Some walls were thrown down. Upwards of 30 shocks occurred at Visalia.—B. Ms.—*Los Angeles Evening Express*, March 26, 1872.
- March 26. Geyser Gulch, near headwaters of the San Joaquin. Miners' cabins in this vicinity were thrown to the ground with violence. This place is 40 or 50 miles from Independence, Inyo County.—B. Ms.—*Fresno Expositor*, April 10, 1872.
- March 26. Grass Valley. Steeple of St. Patrick's Church swayed to and fro violently.—*Grass Valley Union*, March 27, 1872.
- March 26. Sacramento. Several shocks, although no damage was done.—*Folsom Telegraph*, March 30, 1872.
- March 26. Folsom. Three distinct shocks at half-past two in the morning. Salmon Falls, the first shock lasted 2 minutes, and was quite severe.—*Folsom Telegraph*, March 30, 1872.
- March 26. Napa.—*Napa Reporter*, March 30, 1872.
- March 26. See article by Prof. LE CONTE.—*S. F. Bulletin*, April 12, 1872.
- March 26. Los Angeles. B. Ms.—*Los Angeles Evening Express*, March 26, 1872.
- March 26, 2:25 A. M. Placerville, Placer County, two or three distinct shocks in quick succession.—B. Ms.—*Placerville Democrat*, March 30, 1872.
- March 26. Monitor.—B. Ms.—*Alpine Miner*, March 30, 1872.
- March 26. Nevada City, two shocks were felt, severe enough to cause nausea.—B. Ms.—*Nevada City Daily Transcript*, March 27, 1872.
- March 26. The shock was reported as light at Antioch, Martinez, Santa Cruz, Pacheco, Napa.—H. Ms. At Woodland, Yolo County, the shock was felt at 2:25 A. M., and lasted 30 seconds.
- March 26. The shock was reported as severe, or very severe, at Sacramento, Visalia, Red Bluff, Copperopolis, Sonora, Sutter Creek, Forest and Iowa Hills, Placerville, San José, Stockton, Santa Barbara, Hill's Ferry (Stanislaus County), Pescadero, and along the coast, Woodland (Yolo County), Chico, Colusa, Alpine County, San Diego, Salinas, Virginia City (Nev.), Marysville, Bakersfield, Los Angeles, San Juan Capistrano, Fort Tejon, Flores, Inyo Valley, Mariposa, Calaveras, Eureka.—H. Ms.
- March 26. Articles on this earthquake may be found in *S. F. Bulletin*, March 26, 27, 28, 29, 30, April 1, 2, 3, 5, 8, 13, 24, May 10, 17; *Atlas*, March 31, April 3; *Call*, March 27, 31, April 13, May 17; *Chronicle*, March 29 to May 4; *S. F. Golden Era*, March 31; *Pacific Observer*, March 29; *Inyo Independent*, April 6.
- March 26. Accounts in *Mining and Scientific Press*, March 30, 1872, April 6 (description of the region by H. G. HANKS), April 30, May 11 (underground shocks), May 25. Professor WHITNEY, in *Overland Monthly*, Vol. 9, gives a very full and scientific account of this earthquake. "A fissure was opened in the earth from about 2 miles north of Lone Pine, extending 10 miles further north. This fissure was 4 feet wide, and the ground on the east side sank from 4 to 12 feet lower than that on the west side (or the west side was raised). At the same time the ground on the east side was moved bodily 10 feet or so towards the north (or the other to the south). This was clearly shown by the position of fences running east and west."—Verbal account of Capt. KEELER, who has given me a photograph showing the shifting of the fences.

- 1872. March 28;**
Nevada City, Cal.—B. Ms.
- 1872. March 28;**
Visalia.—B. Ms.
- 1872. March 29;**
Los Angeles, Cal; shock lasting 49 seconds, the longest ever felt here, though not the most severe.—B. Ms.
- 1872. April 3; early in the morning.**
Two sharp shocks; Visalia, Cal.—B. Ms.
- 1872. April 3; 4:15 a. m.**
Stockton.—B. Ms.
- 1872. April 9; 7 a. m.**
Visalia.—B. Ms.
- 1872. April 10; 3 to 4 a. m.**
Visalia, several shocks.—B. Ms.
- 1872. April 10; evening.**
Sharp shock of extraordinary length.—B. Ms.
- 1872. April 10 ?; 7:10 p. m.**
Stockton.—B. Ms.
- 1872. April 10; 7:20 p. m.**
Heavy shock at Tuolumne, which was also felt at Mokelumne Hill.—B. Ms.
- 1872. April 11;**
Tuolumne; severe shock, 4 A. M.; another, 5:30 A. M.; one more severe at 1 A. M. (*sic*); another at 9:30 P. M.; another severe at 10 P. M.—B. Ms.
- 1872. April 12;**
Tuolumne, three shocks, 2:30 A. M.; one at 4 A. M.; two at sunrise.—B. Ms.
- 1872. April 13;**
Round Valley, Inyo County, severe shock.—B. Ms.
- 1872. April 18;**
Cerro Gordo, Inyo County, very severe shock.—B. Ms.
- 1872. April 23;**
Placerville, Cal.—B. Ms.
- 1872. April 28;**
Millerton, Fresno County, Cal. A shock as violent as that of March 26, 1872, though shorter.—B. Ms.
- 1872. April 28;**
Severe shock at Nevada City, Cal., 8 seconds duration.—B. Ms.
- 1872. April 30;**
Marysville, two light shocks.—B. Ms.
- 1872. May 1;**
Salinas, Gilroy, Cal.—*Mining and Scientific Press*.
- 1872. May 21;**
Shocks are still frequent in Inyo County. A number of the old craters are still emitting steam.—B. Ms. *Alta*, May 22, 1872.
- 1872. June 15;**
Millerton, Fresno County, Cal.—B. Ms.

1872. August 23; 4 p. m.

Earthquake waves at Ft. Point for 20 hours.—*Mining and Scientific Press.*

1872. September 14;

Owens River Valley, Inyo County, Cal.—C. G. R. Sharp shocks, but no damage done.—*Mining and Scientific Press.*

1872. September 18; evening.

Yountville, Napa County, Cal.—B. Ms.

1872. October 1;

San Francisco, Cal.—S. F. D.

1872. October 2;

San Francisco, Cal.—C. G. R.

1872. October 12; 4:10 a. m.

Sharp shock. San Francisco, Cal.—T. T. Also Oakland.—C. G. R.

1872. October 18;

Millerton, Fresno County, Cal.—B. Ms.

1872. October 19;

Millerton, Fresno County, Cal.—B. Ms.

1872. October 21; 8:05 p. m.

Light shock, San Francisco, Cal.—T. T. Petaluma.—B. Ms. Also Val-lejo, San Rafael.—B. Ms.

1872. November 12; at night.

Stockton, Cal.—C. G. R.

1872. November 21;

Petaluma.—B. Ms.

1872. December 14; 9:20-9:40 p. m.

Oregon and Washington Territory.—C. G. R.

1872. December 14, 15, 16;

Olympia, W. T. Professor GEORGE DAVIDSON kindly refers me to an account of these earthquakes in the *Weekly Pacific Tribune*, Olympia, December 21, 1872: "In an unofficial report to Professor DAVIDSON, at San Francisco, Captain LAWSON says, December 14, 1872: Shock occurred precisely at 9h. 40½m. It commenced with a slight movement, gradually increasing for 18 or 20 seconds. Then came the heavy shock, lasting 4 or 5 seconds; then it gradually decreased. In six minutes after the first shock there was another, followed by two others, one minute apart. At 10h. 12m. 40s. there was another shock, and after 11 p. m. there were five others. During the night, other shocks were reported (I did not feel them) at 3 and 5 o'clock. On Sunday evening, December 15, at 6h. 37½m., a light shock. December 16, at 9h. 17m. 30s. A. M., another light shock. This shock was felt as far south as Eugene, in Oregon, and as far north as British Columbia—probably even in Alaska. In Victoria and elsewhere on Vancouver Island, the shock is said to have been heavier than at any other point heard from. In Olympia we have heard of but a single article broken or damaged by the shock. This was a statuette, which was thrown from top of a whatnot and smashed on the floor. In the Seattle stores, we are informed, considerable quantities of crockery and glassware were broken. From what is so far known, the earthquake was confined mainly to the Puget Sound Basin, thence extending north and south with a gradually decreasing force, until it disappeared in a distance of 400 or 500 miles." The direction of the shock (December 14) at Olympia, was south to north at first, then southeast to northwest.

1872. December 15;

A shock was felt at various places near Puget Sound, W. T.—C. G. R.

1872. December 16;

Visalia.—B. Ms.

1872-1875. (March);

No shocks at San Diego in this period.—B. Ms.

1873. February 2; 3:30 p. m.

Light shock, San Francisco, Cal.—C. G. R.

1873. February 3; 3 p. m.

Light shock at San Francisco; severe at San José and Santa Clara.—C. G. R. Two shocks.—S. F. D.

1873. March;

San Diego Union speaks of a newly discovered volcanic region near Moleje, in Lower California. In 1872 twenty distinct shocks were felt; in 1870 five severe shocks.—C. G. R.

1873. April 10;

Mission San José.—B. Ms.

1873. April 12; in the evening.

Three light shocks, San Francisco, Cal.—C. G. R.

1873. April 21;

Mission San Gabriel.—C. G. R.

1873. May;

San Bernardino.—B. Ms.

1873. June;

San Bernardino.—B. Ms.

1873. July 15;

Slight shock, Napa, Cal.—C. G. R.

1873. August 29; 4 p. m.

Heavy shock at San José, Cal.—C. G. R. Severe shock at Redwood, San Mateo County; time not given.—B. Ms. *S. F. Post*, September 3, 1873.

1873. October 12; 1:15 a. m.

San Diego, Cal.—C. G. R.

1873. October 19; 2 p. m.

Slight shock, Seattle, W. T.; 4 p. m., clouds of smoke were seen pouring from the highest peak of Mt. Rainier.—C. G. R.

1873. November 5;

Nevada.—B. Ms.

1873. November 22; a little after 9 p. m.

A shock was felt from Portland, Oregon, to San Francisco, Cal.; most severe at Crescent City, Cal., and Port Orford, Oregon.—C. G. R. Nearly every brick building in Crescent City was injured; chimneys were damaged there and up the coast to Port Orford, in the interior as far as Jacksonville, Oregon, and east from Crescent as far as Happy Camp, on the Klamath.—B. Ms.

November 22. Severe shock at Linckville, Klamath Lake, Oregon. In Jackson and Josephine Counties, Oregon, and Trinity County, Cal., the shock was strong, and lasted nearly a minute.—B. Ms.—Ft. Klamath, Oregon.—B. Ms.

November 22. This shock was very severe in Washington Territory.—B. Ms.

1873. December 3;

Sharp shock, Santa Clara, Cal.—C. G. R.

1874. January 18;

Two slight shocks, San Francisco, Cal.—C. G. R.

1874. January 19;

Slight shock, San Francisco, Cal.—C. G. R.

- 1874. March 5; 4:53 a. m.**
Sharp and short shock at San Francisco, Cal.—T. T.
- 1874. March 29;**
Alpine County.—B. Ms.
- 1874. May 24; 2 a. m.**
Two sharp shocks, San Francisco, Cal.—C. G. R. Slight shock.—S. F. D.
- 1874. June 11; 8 p. m.**
Two sharp shocks, San Francisco, Cal.—C. G. R.
- 1874. August 3; in the evening.**
Light shock, Clifton, San Bernardino County, Cal.—C. G. R.
- 1874. August;**
Gilroy, Santa Clara County, Cal.—B. Ms.
- 1874. December 10;**
Nevada [Cal. ?]—B. Ms.
- 1874. December 14;**
San Francisco Cal.—B. Ms.
- 1875. January 24; 4 a. m.**
Heavy shock in Butte, Plumas, and Sierra Counties, Cal.—C. G. R. At Oroville, Taylorsville, Greenville, and Downieville.—B. Ms.
- 1875. February 7; 2 a. m., 10:45 a. m., 11:45 a. m.**
Three shocks, San Francisco, Cal.—C. G. R.
- 1875. June 16;**
San Francisco, Cal.—C. G. R.
- 1875. June 18; forenoon.**
Slight shocks in San Francisco.—C. G. R.
- 1875. June 18; 3:35 a. m.**
Sharp shock, San Francisco, Cal.—T. T. 3 A. M.—S. F. D.
- 1875. August 8; in the morning.**
Heavy shock was felt at Hollister, Cal.—C. G. R.
- 1875. October 14; 6 p. m.**
A sharp shock at San Francisco and in the Santa Clara Valley, Cal., with a heavy sea, without wind, from Santa Cruz to Cape Mendocino.—C. G. R. 5:55 P. M., S. F., Cal.—T. T.
- 1875. November 2;**
A severe shock at Fort Yuma, Arizona.—C. G. R.
- 1875. November 7;**
Heavy shock in San Benito County, Cal.—C. G. R.
- 1875. November 14; 7:52 p. m.**
Two shocks at San Francisco, Cal.—T. T. San José.—U. S. W. R.
- 1875. November 15; 7:55 p. m.**
San Francisco, Cal.—C. G. R.
- 1875. November 27; 10:18 p. m.**
San Francisco, Cal.—T. T.—C. G. R.
- 1875. December 2; 2:40 p. m.**
Three shocks, Marysville, Yuba County, Cal.—B. Ms. See December 3.
- 1875. December 3; afternoon.**
Grass Valley, Cal.—C. G. R. [Probably December 2d?]

- 1875. December 21;**
Santa Barbara, Cal.—C. G. R.
- 1875. December 23; night.**
In Placer, Nevada, and Yuba Counties, Cal.—C. G. R.
- 1875. December 24; in the evening.**
Grass Valley, Cal.—C. G. R.
- 1876. January 21; between 3 and 4 a. m.**
San José, Santa Cruz, and San Francisco.—C. G. R.
- 1876. March 25; 6 a. m., 1 p. m.**
Two slight shocks, Oakland, Cal.—C. G. R.
- 1876. May 10;**
Santa Barbara, Cal.—C. G. R.
- 1876. August 16; 1:15 p. m.**
Lat. 41° 55' N., long. 126° 25' W., off the southern part of Oregon.—C. G. R.
- 1876. October 6; 9:20 and 10:08 p. m.**
San Francisco, Cal., Oakland, San José, and Angel Island.—C. G. R.
- 1876. October;**
White Sulphur Springs. ?—B. Ms.—Ashland (Oregon) *Tidings*, October 28, 1876.
- 1876. December 11; 7 p. m.**
At Silver Mountain, Cal., a series of seven shocks within thirty minutes. A slight shock at 3 o'clock the next morning.—C. G. R.
- 1877. January 10; 1:15 ?**
A sharp shock at Los Angeles, Cal.; at Benedict Cañon, near there, three distinct shocks.—C. G. R.
- 1877. January 13; about noon.**
A heavy earthquake forty-five miles southeast of San Diego.—C. G. R.
- 1877. February 17; morning.**
Heavy shock at Quincy, Plumas County, Cal.—C. G. R.
- 1877. May 30; between 2 and 3 a. m.**
Heavy shock at Paso Robles, Cal.—C. G. R.
- 1877. May;**
Tidal waves at San Francisco. Diagram given at p. 169 of MILNE's *Earthquakes*.
- 1877. June 23; a few minutes before midnight.**
Santa Barbara, three shocks.—B. Ms. 11:30 p. m., Bakersfield, Cal.—C. G. R.
- 1877. July 2; 10:35 a. m.**
Gilroy.—B. Ms. *S. F. Bulletin*, July 5, 1877.
- 1877. July 9;**
A shock at Sacramento, Cal., lasting one minute.—C. G. R.
- 1877. August 17; 7:30 p. m.**
Heavy shock at Campo, Cal.—C. G. R.
- 1877. August 27;**
Eureka, Humboldt County, Cal.—B. Ms.
- 1877. August;**
S. F., Cal.—B. Ms. *Antioch Ledger*, September 1, 1877.

- 1877. September 7; 10 p. m.**
Yuma, Arizona.—FUCHS.
- 1877. September 19; about 4 p. m.**
Los Angeles, Cal.—B. Ms.—*S. F. Bulletin*, September 22, 1877.
- 1877. September 29; 2:30 p. m.**
Campo, Cal.—C. G. R.
- 1877. October 12; 1:53 p. m.**
Portland, Oregon; 1:45 p. m., Marshfield, Oregon; 1:52 p. m., Cascades, Oregon;
9 A. M., Cascades, Oregon.—C. G. R.
- 1877. November 24; 6:30 a. m., 6:50 a. m.**
Two shocks at Red Bluff, Cal.—C. G. R.
- 1878. January 8;**
Santa Barbara, Cal.—B. Ms.—*S. F. Golden Era*, January 12, 1878.—*Stockton Independent*, January 10, 1878.
- 1878. February 26; 11:56 a. m.**
San Francisco, Cal.—U. S. W. R.
- 1878. March 17;**
Two shocks at St. Thomas, Lower California.—U. S. W. R.
- 1878. March 18; 6:30 a. m.**
Tacoma, W. T.—U. S. W. R.
- 1878. April 23; 10 a. m.**
Heavy earthquake at *Loreto*, Gulf of California. Shocks continued till May
3d.—FUCHS.
- 1878. May 8; 8:25 p. m.**
From Red Bluff to Sacramento City, Cal.—C. G. R.
- 1878. May 21;**
San Bernardino, Cal.—U. S. W. R.
- 1878. June 11-12; 11:12 p. m.; 11:20 p. m.; 2:30 a. m., and 6:30 a. m.**
Four shocks at Los Angeles, Cal.—U. S. W. R.
- 1878. July 2; 5h. 55m. 30s. (a. m. or p. m.?)**
Two light shocks at Campo, Cal.—U. S. W. R.
- 1878. July 26; 8:25 a. m.**
Los Angeles, Cal.—C. G. R.; and San Bernardino.—FUCHS.
- 1878. September 7; about 9:35 a. m.**
Three shocks at San Francisco, Cal.—U. S. W. R.
- 1878. September 7; 11 a. m.**
Severe earthquake in the southern portion of Humboldt County, Cal.—B.
Ms.
- 1878. September 29; 6 p. m.**
San Francisco and Oakland, Cal.—C. G. R.
- 1878. October 11; 7:30 p. m.**
A severe shock at San José, Cal.—U. S. W. R.
- 1878. October 21; 5:40 p. m.**
Two shocks at Sacramento, Cal.—U. S. W. R.
- 1878. November 11; 9:45 a. m.**
A slight shock at San Francisco, Cal.—U. S. W. R.
- 1878. December 9; 3:20 p. m.**
A severe shock at Red Bluff, Cal.—C. G. R.

1878. December 17; 4 p. m.

Two shocks at Campo, Cal.—C. G. R. Also Yuma, Arizona.—FUCHS.

1879. February 4; 0h. 8m. a. m.

A shock at Visalia, Cal.—C. G. R.

1879. February 19; a few minutes after 5 a. m.

San Francisco, Cal.—C. G. R.

1879. May;

?—B. Ms.—*Esmeralda Herald*, May 31, 1879.

1879. May 26; 8:40 p. m.

Princeton, Colusa County, Cal.—U. S. W. R.

1879. August 10; 1:15 p. m.

A light shock at Los Angeles, Cal. Tidal-wave at Santa Monica. Heavy shock at San Fernando.—C. G. R.

1879. August 18;

A shock at Fiske's Mills, Sonoma County, Cal.—C. G. R.

1879. October 2; 6:30 a. m.

Oakland, Cal.—C. G. R.

1879. December 7; 8:15 p. m.

A slight shock at Los Angeles, Cal.—U. S. W. R.

1879. ? ?

There was a smart shock in Portland, Oregon—and only two or three shocks have been felt since that time.—Communicated by GEO. J. AINSWORTH, Esq.

1880. January 9; 5:45 a. m.

Santa Cruz, Gonzales, and Hollister, Cal.—C. G. R.

1880. March 21; 6:25 a. m.

A heavy shock, Los Angeles, Cal.—U. S. W. R.

1880. March 25; 2:30 a. m.

Moderate shock, San Geronio, Cal.—U. S. W. R.

1880. April 12; 4:40 a. m.

Severe shock at Los Angeles; most severe on San Gabriel River; 4:30 A. M. sharp shock at Riverside, San Bernardino County.—*S. F. Chronicle*, April 13, 1880.

1880. April 12; 8:03 a. m.

Severe shock at San Buenaventura, Ventura County, Cal.—*S. F. Chronicle*, April 13, 1880.

1880. April 14; 1:05 p. m.

Strong shock, San Francisco.—C. G. R. Oakland.—B. Ms.

1880. May 5; 11 p. m.

Slight shock, San Francisco, Cal.; 11:35 P. M., San José.—C. G. R.

1880. June 24; 12:47 a. m.

San Francisco, Cal.—U. S. W. R.

1880. August 22; 1:25 p. m.

Southern part of Vancouver Island and northwest part of Washington Territory.—FUCHS.

1880. August 29; 1:10 p. m.

A slight shock, San Diego, Cal.—U. S. W. R.

1880. September 26; 5:40 p. m.

Los Angeles, Cal.—U. S. W. R.

- 1880. November 4; 7:37 p. m.**
Sharp shock at San Francisco, Cal. Felt slightly at San José.—C. G. R.
- 1880. November 6;**
Newcastle, Cal.—FUCHS.
- 1880. November 12; 8:45 p. m.**
Slight shock at Los Angeles, Cal.—C. G. R.
- 1880. November 12; 10:30 p. m.**
Santa Barbara, Cal.—C. G. R.
- 1880. November 21; 8:10, 11 p. m., and 2:30 a. m.; 7:45, 9:45, and 11 p. m.**
Los Angeles, Cal.—C. G. R.
- 1880. December 7; 5:54 p. m.**
Olympia, W. T.; also at Bainbridge Island, W. T.—C. G. R.
- 1880. December 10; 5 a. m.**
Bainbridge Island, W. T.—U. S. W. R.
- 1880. December 12; 8:40 p. m.**
Severe shock near Puget Sound, W. T., from Victoria to Portland.—C. G. R.
- 1880. December 14; 7 p. m.**
Slight shock was felt at Bainbridge Island, W. T.—U. S. W. R.
- 1880. December 19; between 2 and 3 a. m.**
Los Angeles, Cal. 3:40 p. m., from Los Angeles to San Diego.—C. G. R.
- 1880. December 20; 11:16 p. m.**
Bainbridge Island, W. T.—U. S. W. R.
- 1880. December 21; 11 p. m.**
Sharp shock at San Diego and Campo, Cal. 3:22 a. m., Campo, Cal.—C. G. R.
- 1880. December 26; 2:30 p. m.**
Tecaluma, San Diego County, Cal.—U. S. W. R.
- 1880. December 28; 11 p. m.**
Severe shock, Tecaluma, Cal.—U. S. W. R.
- 1880. December 29; 11:25 p. m.**
Slight shock, Bainbridge Island, W. T.—U. S. W. R.
- 1881. January 1; 6:55 p. m.**
Red Bluff, Cal.—U. S. W. R.
- 1881. January 5-7;**
Bainbridge Island, W. T. Slight shocks at 10:56 p. m. of 5th. Slight shocks 4:20 p. m. of 6th. Slight shocks at 10:15 p. m. of 7th.—U. S. W. R.
- 1881. January 6; 6:25 p. m.**
Red Bluff, Cal.—U. S. W. R.
- 1881. January 7; 6:15 a. m.**
Slight shock, Campo, Cal.—U. S. W. R.
- 1881. January 16; 11 p. m.**
Slight shock, Bainbridge Island, W. T.—U. S. W. R.
- 1881. January 24; 8:54 p. m.; 9:15 p. m.; 11:15 p. m.**
Three shocks, San Francisco and Oakland, Cal.—C. G. R.
- 1881. January 30; 9:45 p. m.**
Slight shock, Bainbridge Island, W. T.—U. S. W. R.

1881. February 1; 4:11 p. m. (three shocks); 9:53 p. m. (two shocks).
Visalia, Cal.—U. S. W. R.
1881. February 2;
Slight shock at Salinas City, Cal.—U. S. W. R.
1881. February 14; about 1 o'clock.
Slight shock at Ukiah, Cal.—C. G. R.
1881. March 14; 10:30 p. m.
Slight shock at Bainbridge Island, W. T.—U. S. W. R.
1881. April 10; 2 a. m.-2:15 a. m.
Several severe shocks in Central California.—C. G. R.
1881. April 27; 9:10 p. m.
Los Angeles, Cal.—U. S. W. R.
1881. May 14; 13h. 9m.
Slight shock at Berkeley, Cal.—*Trans. Seismol. Soc. of Japan*, vol. x, p. 95.
1881. June 30; 8 a. m.
Sharp shock at Campo, Cal.—U. S. W. R.
1881. July 2; 11 p. m.
San Juan, San Benito County, Cal.—C. G. R.
1881. July 3; 2:10 a. m.
Heavy shock at Hanford and Visalia, Cal.—C. G. R.
1881. August 30; 7 p. m.
Two slight shocks at Santa Barbara, Cal.—U. S. W. R.
1881. September 18; 5:20 p. m.
Severe shock at San Francisco, Cal.—C. G. R.
1881. October 2; 9 a. m.
Sharp shock, Campo, Cal.—U. S. W. R.
1881. October 31; 4:10 p. m.
Slight shock, San Francisco, Cal.—T. T.
1881. November 11; 4 p. m.
Slight shock, San Francisco, Cal.—U. S. W. R.
1881. November 13; 11:15 p. m.
Smart shock, San Francisco, Cal.—T. T. 11:20 p. m.—U. S. W. R.
1881. November 15; at noon.
San José, Cal.—C. G. R.
1882. January 26; evening.
Two severe shocks, Centerville, Cal.—C. G. R.
1882. February 3; 2:40 a. m.
Sharp shock, San Geronio, Cal.—U. S. W. R.
1882. March 6; 2 p. m.
Successive shocks at Merced; 1:57 p. m., two severe shocks at Santa Cruz; 1:45 p. m., two severe shocks at Gilroy; 1:45, one severe shock at Monterey; 1:47½ severe shock at Watsonville.—B. Ms.—*S. F. W. Call*, March 9, 1882.
1882. March 11; 3:30 p. m.
Poway, San Diego County, Cal.—C. G. R.
1882. March 11; 4 p. m.
Slight shock, San Diego, Cal.—C. G. R. 4:25 p. m.—H. Ms.

1882. March 16; 1:46 p. m.

Light shock, San Francisco, Cal.—U. S. W. R.

1882. March 7;

Two slight shocks in Salinas, Cal., during the month.—FUCHS.

1882. April 13; 6:30 a. m.

Sharp shock, San Francisco, Cal.—U. S. W. R.

1882. April 30; 10:48 p. m.

Two shocks, Portland, Oregon.—C. G. R.

1882. May 1; 12:25 a. m.

Portland, Oregon.—FUCHS.

1882. June 27; 5:22 a. m.

Two severe shocks, four seconds apart, San Francisco, Cal.—C. G. R. Also Hollister and Stockton.—FUCHS.

1882. July 15; 7:45 p. m.

Sharp shock, San Francisco, Cal.—C. G. R. Heavy shock at Centerville, Alameda County.—H. Ms.

1882. July 22; 11:08 a. m.

Very light shock at San Francisco, Cal.—U. S. W. R.

1882. July 31; about noon.

Light shock at Cape Mendocino, Cal.—U. S. W. R.

1882. August 8;

Light shocks at Oakland, Cal.—U. S. W. R.

1882. August 9; 8:45 p. m.

Light shock at San Francisco, Cal.—U. S. W. R.

1882. August 13; night.

Seven shocks at Round Valley, Inyo County. Two shocks between 12 and 1, night, were very severe.—H. Ms.

1882. August; twice during the month.

Salinas, Cal.—U. S. W. R.

1882. September 30; 10:57 a. m.

Sharp shock at Campo, Cal.—U. S. W. R.

1882. October 8; 2 a. m.

Heavy shock at San Diego, Cal.—C. G. R.

1882. October 9;

In the past week, three shocks at Cape Haytien, W. T.—FUCHS.

1882. October 20; 2:15 a. m.

Severe shock at San Francisco, Cal.—C. G. R.

1882. October 20; 3:10 a. m.

Sharp shock in San Francisco, Cal.—T. T.

1882. October 31; 6:45 p. m.

Sharp shock, San Francisco, Cal.; felt, also, at Sonoma, Napa, Petaluma, and San Rafael.—C. G. R.

1882. November 11; 7:30 a. m.

Severe shock at Mendocino.—H. Ms.

1882. December 19; 11:45 p. m.

Two light shocks, Visalia, Cal.—U. S. W. R. Bakersfield, two shocks at 11:30.—H. Ms.

1883. January 23; 5h.

Slight shock, Los Angeles, Cal.—U. S. W. R.

1883. January 23; 11:40 p. m.

Light shock in San Francisco, Cal.—T. T. Sharp shock.—U. S. W. R.

1883. February 6; 16h. 30m.

Slight shock, San Diego, Cal.—U. S. W. R.

1883. March 21; shortly before 1 a. m.

Centerville (Alameda County), severe.—H. Ms.

1883. March 21; 4:30 a. m.

Mendocino.—H. Ms.

1883. March 30; 7h. 48m., 7h. 52m., 8h. 15m.Three shocks, San Francisco, Cal.; nine shocks, Watsonville.—C. G. R.
Light shock, S. F., 8:10 A. M.—T. T. 7:39 A. M., at Hollister; very heavy shock, windows broken, etc.—H. Ms.

March 30. 7:45 A. M.; Santa Cruz, three shocks. 7:42 A. M.; Watsonville, violent shocks, nine in all; pendulum clocks were stopped. 7:35 A. M.; San Luis Obispo. 7:50 A. M.; Centerville, three shocks. About 8 A. M.; Mission San José, several sharp shocks. 7:40 A. M.; Gilroy, glass broken. 8 A. M.; Martinez, two shocks. 7:40 A. M.; Salinas. 7:45 A. M.; Monterey.—H. Ms.

1883. April 2; 8h. 50m.

Two light shocks, San Francisco, Cal.—U. S. W. R.

1883. July 7; 10h. 50m.

Light shock at Los Angeles, Cal.—U. S. W. R.

1883. July 30;

Two shocks, Gilroy, Cal.—C. G. R. July 31?—Fuchs.

1883. August 4; 11h. and 12h. 50m.

Two light shocks at Oakland, Cal.—U. S. W. R.

1883. August 31;

Los Angeles.—H. Ms.

1883. September 1; 8h. 25m.

Light shock, Los Angeles, Cal. A second shock four seconds later.—U. S. W. R.

1883. September 5; 4h. 30m.

Shocks at Los Angeles, Santa Barbara, Wilmington, and San Buenaventura, Cal.—C. G. R.

1883. September 13; 14h. 30m.

Santa Barbara, Cal.—U. S. W. R.

1883. September 28; about midnight.

Two shocks, Portland, Oregon.—C. G. R.

1883. October 9; 23h. 3m.

Two light shocks, San Francisco, Cal.—C. G. R.

1883. October 27 or 29

6:45 P. M., light shock at Salinas; 7:50 P. M., much stronger at Salinas; 9:45 P. M., another at Salinas; Santa Cruz, a severe shock.—H. Ms.

1883. October 10; 1:05 a. m.

Sharp shock in San Francisco.—T. T. Heaviest since 1868.—B. Ms. Not felt at Sacramento. Severe at Gilroy and Port Costa.—H. Ms. Davisville reports a severe shock; Berkeley; Oakland.—H. Ms. DETAILLE (L'As-tronomie, 1885, p. 188).

1883. October 16; 3h. 15m.

A slight shock at Cape Mendocino, Cal.—U. S. W. R.

1883. October 22; 6 a. m.

South side of the Merced River, below Merced Falls; a shock threw a section of the bluff two hundred feet by sixty by eighty feet, into the river. A sharp shock a few minutes before midnight.—H. Ms.

1883. October 24; 16h. 14m.

A severe shock at Cape Mendocino, Cal.—U. S. W. R.

1883. October 30; in the morning.

Two light shocks at Oakland, Cal.—U. S. W. R. Light shock at S. F.—T. T.

1883. November 11; 18h. 15m.

Slight shock at Poway, San Diego County, Cal.—U. S. W. R.

1883. December 3;

Severe shock at Shasta, Cal.—H. Ms.

1883. December 12; 23h. 40m.

A slight shock at Los Angeles, Cal.—U. S. W. R.

1883. December 12; 1:50 a. m.

Heavy shock at Salinas, Cal.—H. Ms.

1883. December 13;

Los Angeles, Cal.—U. S. W. R.

1883. December 16? 15h.

A slight shock at Poway, San Diego County, Cal.—U. S. W. R.

1884. January 3; 20h. 40m.

A light shock, Portland, Oregon.—U. S. W. R.

1884. January 4; 11h. 56m.

Very light shock, Los Angeles, Cal.—U. S. W. R.

1884. January 25.

Professor GEORGE DAVIDSON, of the U. S. C. S., reported from San Francisco that at 19h. 24m. earthquake waves were indicated by the levels of the astronomical instruments of the observatory, and they continued for twenty minutes.—C. G. R.

1884. January 27; 23h. 30m.

Moderate earthquake in Humboldt County, Cal. A second shock five minutes later.—C. G. R.

1884. March 15; 3h. 7m.

Very light shock, San Francisco, Cal.—C. G. R.

1884. March 25; 4:40 p. m.

Severe shock, San Francisco, Cal. At 5:17 another less severe. Shocks felt from Santa Cruz to Petaluma.—FUCHS. 4:44 p. m.—T. T. Professor DAVIDSON gives times of three shocks. At Gilroy, severe shock; at Center-ville, light; at Santa Cruz, severe; at Petaluma, quite severe; at Redwood City, quite severe; Mission San José, two heavy shocks; Spanishtown, severe; San José; Grass Valley.—H. Ms.

1884. April 6; 6h. 20m.

A very light shock at Eureka and Hydesville, Humboldt County, Cal.—C. G. R.

1884. April 8.

In the morning very light shocks, Eureka, Cal.—U. S. W. R.

1884. April 11;

Light shock, Eureka, Cal.—FUCHS.

1884. April 17; 21h. 10m.

Light shock at Oakland, Cal.—U. S. W. R.

1884. April 20; 11h. 30m.

A very light shock at Oakland, Cal.—U. S. W. R.

1884. June 6; 1h.

Two strong shocks were felt at Red Bluff, Cal., with an interval of three or four seconds.—C. G. R.

1884. June 12; 8h. 43m.

A strong shock is reported by Captain C. F. SWAN to have been felt at sea, in latitude 40° 24' north, longitude 125° 50' west, being about seventy-five miles west of Cape Mendocino, Cal.—C. G. R.

1884. June 16; 10h. 48m.

Los Angeles, Cal.—U. S. W. R.

1884. July 15; about daylight.

A very light shock at San Francisco, Cal.—U. S. W. R.

1884. August 2-3; in the night.

A very light shock at Santa Barbara, Cal.—U. S. W. R.

1884. August 3;

Lower Lake, Lake County, Cal. Shocks day and night.—H. Ms.

1884. August 4; 1h.

Three very light shocks at Santa Barbara, Cal.—U. S. W. R.

1884. September 21; between 22h. and 23h.

Light shocks were felt at New Tacoma, W. T.—U. S. W. R.

1884. September 26; 10:53 p. m.

Light shock at Yuma, Arizona.—FUCHS.

1884. September 27; 3 a. m.

Light shock, Yuma, Arizona.—FUCHS.

1884. October 2; 2:32 p. m.

Light shock, Rivas, Cal.—FUCHS.

1884. October 2; 3 p. m.; and 4 p. m. (heavy).

San Juan del Sur, Cal.—FUCHS.

1884. October 22; 15h. 34m.

A light shock at Los Angeles, Cal.—U. S. W. R.

1884. November 4; 18h.

Three shocks 150 miles off Cape Mendocino, Cal., followed a few hours later by two heavier ones.—U. S. W. R.

1884. November 9;

Three earthquakes at Hollister, Cal.—A. S.

1884. November 12;

The self-registering tide gauge at Saucelito, Cal., recorded a series of waves probably due to a submarine earthquake.—C. G. R.—*San Francisco Evening Bulletin* of December 13.

1885. January 26; 1h. 33m. 120th meridian time.

A moderate earthquake (V) occurred in Central California from San Francisco, northward, to Napa and Petaluma.—U. S. W. R. Sharp shock, 1:32. T. T.

1885. January 26; 8:57 p. m.

Light shock in San Francisco, Cal.—T. T. Light shock (IV) Central California.—C. G. R.

1885. January 30; about 10:45.

Honey Lake Valley, Lassen County, Cal. Shock lasting over a minute; breaking glass and throwing down chimneys. In the ten days preceding February 8th, probably over one hundred distinct shocks have been felt. Shocks were most severe about Janesville, and on Susan River, twelve miles from Susanville.—H. Ms. See Feb. 26.

1885. January 30; 9:40 p. m.

Shock twenty seconds long in Sierra County.—H. Ms. At Susanville the shocks lasted from 9 p. m. to 4 a. m. Thirteen shocks were felt in places in the valley.—H. Ms.

1885. January 30; 21h. 38m., 120th meridian time.

A very light shock (III) at Sacramento, Cal.—U. S. W. R.

1885. February 5; 23h.

A moderate shock (V ?) at Geyser Springs, Sonoma County, Cal.—C. G. R.

1885. February 6; 2h.

A moderate shock (V ?) at Geyser Springs, Sonoma County, Cal.—C. G. R.

1885. February 7; night.

Four severe shocks at Susanville.—H. Ms.

1885. February 22; 18h. 53m.

A very light shock (III) at Newcastle, Placer County, Cal.—C. G. R.

1885. February 26;

The earthquakes still continue in the vicinity of Susanville. One shock recently, it is said, shook down the curbing of a well. The shocks appear to be local, as none are felt one hundred miles from here. This locality is in Lassen County, in the extreme northeastern part of the State.—(S. F. C.)—C. G. R.

1885. March 30; 28h. 56m., 120th meridian time.

A strong shock (VI) in Central California, from San Rafael, Marin County, to Monterey, Salinas, and Hollister.—C. G. R.

1885. March 31; about 3h.

A very light earthquake (III) at Fall Brook, San Diego County, Cal.—U. S. W. R.

1885. April 2; 7h. 15m.

A very light shock (III) Sacramento, Cal.—C. G. R.

1885. April 2; 7h. 25m.

A light shock (IV) at Merced and Fresno, Cal.—C. G. R.

1885. April 7; 2h.

Santa Barbara and San Buenaventura, Cal.—C. G. R.

1885. April 7; 2h. 30m.

A light shock, Bakersfield, Kern County, Cal.—C. G. R.

1885. April 11; 20h. 5m., 120th meridian time.

A strong shock (VI), Central California.—C. G. R.

1885. April 18; shortly before midnight.

A moderate shock (V), Keeler, Inyo County, Cal.—U. S. W. R.

1885. April 25; 20h. 20m.

A very light shock (III), Hydesville and Blue Lake, Humboldt County, Cal.—C. G. R.

1885. May 3; 23h. 30m., local time.

A very light shock, Olympia, W. T. Light shocks continued until 1h. 30m. of the 4th.—U. S. W. R.

1885. June 14; 8h. 14m., 120th meridian time.

A moderate earthquake, San Buena Ventura, Ventura County, and Los Angeles and Cahuenga, Los Angeles County, Cal.—C. G. R.

1885. June 25; 20h. 30m.

A very light shock (III), Salinas, Cal.—U. S. W. R.

1885. June 27; 5h. 26m.

A light shock (IV), Olympia, W. T.—U. S. W. R.

1885;

Three earthquakes noted during the summer at Kono Tyee, Clear Lake, Cal. by R. S. FLOYD, Esq.

1885. July 9; 1h. 20m. to 8h. 15m.

Five moderate earthquakes (V), Santa Barbara, Cal.—U. S. W. R.

1885. July 22; 19h.

A very light shock (III), Centerville, Cal.—C. G. R.

1885. July 23; 12h. 25m.

A moderate shock (VI), San José, Santa Clara County, and Centerville, Alameda County, Cal.—C. G. R.

1885. July 31; 16h. 10m.

A strong shock (VII), Cloverdale, Sonoma County, Cal.—C. G. R.

1885. September 13; 4h. 34m.

A light shock (IV) in Southern California.—C. G. R.

1885. September 20; about 7 a. m.

San Diego.—H. Ms.

1885. October 9; 8h.

A moderate shock (V), Olympia, W. T.—C. G. R.

1885. October 10; between 1h.-2h.

Three very light shocks (III), East Portland, Oregon.—U. S. W. R.

1885. October 16; 4h. 45m.; 120th meridian time.

A light earthquake (IV) in Central California, very faint in San Francisco, light in San Rafael, and heavier in Napa and Santa Rosa.—C. G. R.

1885. November 19; between 13h. and 20h.

Earthquake waves were indicated on the coast survey tide-gauge at San Francisco.—C. G. R. And on the levels of astronomical instruments at intervals of 35m.—*Nature*.

1885. December 8; 22h. 40m.; 120th meridian time.

A moderate shock (V) Puget Sound, W. T.—C. G. R.

1885. December 8; 10:12 p. m.

Sharp shocks at Victoria and New Westminster, B. C.—H. Ms.

1885. December 18; 0h. 30m.

A very light shock (III) Tatoosh Island, W. T.—U. S. W. R.

1885. December 21; morning.

Slight shock; Susanville.—H. Ms.

1885. December 28; between 3h. and 4h.

Santa Cruz, Cal.—U. S. W. R.—Two heavy shocks.—H. Ms.

1885. December 30; 9:45 a. m.

Light and rattling shock in San Francisco, Cal.—T. T. Around the bay.—C. G. R. Oakland; heavy at Napa at 9:51; severe at Redwood at 9:40; Vallejo Junction and Fort Costa 9:46½; slight at Santa Cruz at 9:45; severe at Petaluma, 9:47; severe at Martinez, 9:50; severe at San Mateo, 9:45.—H. Ms. Probably at San José.—E. S. H.

- 1886. January 26;**
San Francisco and vicinity.—A. S.
- 1886. May 24;**
Fresno, Cal.—A. S.
- 1886. May 25; 3 a. m.**
Two shocks, San Francisco, Cal.—H. Ms.
- 1886. May 26;**
Earthquake shocks felt in different parts of California.—A. S. Santa Cruz (four shocks); Irving (two shocks).—H. Ms.
- 1886. May 26; 12:17 p. m.**
Slight shock, San Francisco, Cal.—H. Ms. *S. F. Bulletin*, May 27, 1887; 0:16 p. m.—T. T.
- 1886. June 7; 1:32 p. m.**
Light shock in San Francisco, Cal.—T. T.
- 1886. July 2; 0:10 a. m.**
Light shock in San Francisco, Cal.—T. T.
- 1886. July 2;**
Stockton, Cal.—A. S.
- 1886. September 3;**
Earthquake shocks felt in several California towns.—A. S.
- 1886 ? 1885 ? October 13; a little after 8 p. m.**
Fort Point Lighthouse, S. F., Cal.—*Report of L. H. Board* for 1885-6.
- 1886. October 15;**
Fort Point Lighthouse, S. F., Cal., 9:59 p. m.; Mare Island Lighthouse, Cal., 10 hours, $\frac{1}{2}$ minute, p. m.—*Report of L. H. Board* for 1885-6. 10:05 p. m., S. F., Cal.—T. T.
- 1886. November 11; 7:11 p. m.**
Slight shock at San Francisco.—A. S.
- 1886. December 6;**
San Francisco; also Santa Cruz.—A. S.
- 1887. January 3; 4:29 p. m.**
Humboldt Lighthouse, Cal.—*Report of L. H. Board* for 1885-6.
- 1887. January 8; 2:20 a. m.**
Cape Mendocino Lighthouse, Cal.—*Report of L. H. Board* for 1885-6.
- 1887. January 11; 4:11 a. m.**
Fort Point Lighthouse, S. F., Cal. Pigeon Point Lighthouse, Cal., 4 a. m.—*Report of L. H. Board* for 1885-6. 4:10 a. m., S. F., Cal.—T. T. Two shocks.—A. S.
- 1887. January 15; 10:58 p. m.**
Point Arena Lighthouse, Cal.—*Report of L. H. Board* for 1885-6.
- 1887. January 19; 3:15 a. m.**
Point Arena Lighthouse, Cal.—*Report of L. H. Board* for 1885-6.
- 1887. January 19; 10:25 p. m.**
Mare Island Lighthouse, Cal.—*Report of L. H. Board* for 1885-6.
- 1887. April 24; night.**
Slight shock recorded on seismometer of Lick Observatory.
- 1887. May 3;**
Slight shock recorded on seismometer at Lick Observatory.

1887. May 3; 2:48 p. m.

I have no record of this shock at Fort Yuma, but I assume it to have been felt there. In *Science*, 1887, May 20, p. 483, under the heading, *The Sonora Earthquake*, is a good account by G. E. GOODFELLOW, of the shock at Tombstone, Arizona. At this place there were loud detonations. The severe shaking lasted 10 seconds, the moderately severe about 20, and tremors a little over 1 minute. No building of any stability was damaged, and no person was injured. The railroad track of the A. T. and St. F. R. R., at a point where it ran east and west, was thrown $4\frac{1}{2}$ inches out of line, the convexity looking south. The bend was 300 feet long. For 48 hours after the shock there were tremors. Miners 600 feet below the surface felt the shock severely, and some became sick. Miners at 150 feet noticed the shock less. The area of disturbance is estimated at 1,200 by 600 miles. In Fronteras Valley, Sonora, old Mexico, and the neighborhood, the shock was destructive to houses, and to human life. Fissures north and south were produced. The center is probably south of Fronteras. At San Bernardino Ranch, 90 miles southeast of Tombstone, all the houses were thrown down. There are extinct craters at this place.

1887. May 4;

Slight shock recorded on seismometer at Lick Observatory.

1887. June 9; 9:04 p. m.

Humboldt Light Station.—*Letter from Naval Secretary L. H. Board.*

1887. June 24; 9:20 a. m.

Cape Mendocino Lighthouse. A single heavy shock, stopping the clock at 9:20 A. M., and lasting two seconds. No damage was done.—*Letter from Naval Secretary L. H. Board.*

1887. June 24; 9:24 a. m.

Humboldt Light Station. Clock was stopped.—*Letter from Naval Secretary L. H. Board.*

1887. July 6; 10h. 15m. 10s. p. m.

Recorded on seismometer at Lick Observatory. Sudden shock lasting not more than five seconds. Direction northwest and southeast. Amplitude $\frac{1}{16}$ of an inch. The exact time of the shock was noted by Mr. J. E. KEELER.

1887. July 8; 4 to 7:30 p. m.

An examination of the Coast Survey tidal register, for July, at Saucelito, shows that at 4 o'clock P. M. on the 8th of July, a sharp earthquake wave entered the harbor of San Francisco. The waves gradually grew smaller, and disappeared at 7:30 P. M.—*S. F. Bulletin.*

1887. August 13; 3h. 17m. a. m.

"A very severe shock" at Point Pinos Light Station; duration of shock, eleven seconds.—*Letter of Naval Secretary L. H. Board.*

1887. August 13; 6:55 p. m., standard time.

Santa Cruz Light Station.—*Letter of Naval Secretary L. H. Board.*

1887. August 17; 4:01 a. m.

Slight shock at Fort Point Light Station, Presidio, San Francisco, Cal.—*Letter of Naval Secretary L. H. Board.* 3h. 57m. A. M., lasting three seconds.—E. S. H. 4 A. M., San Mateo.—*S. F. Bulletin*, August 18, 1887.

1887. August 19; 1 a. m.

Berkeley, Cal.—Reported by Professor SOULÉ, University of California.

1887. August 24;

San Diego felt two slight earthquakes yesterday.—*S. F. Bulletin*, August 25, 1887.

1887. September 9; 3:58 p. m.

Single shock in S. F., Cal. ? Somewhat doubtful.—E. S. H.

1887. September 19;

Mariposa; light earthquake accompanied by heavy rumbling noise.—*S. F. Bulletin*, September 20th.